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JULY 1999

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Improving portable radio mic technology

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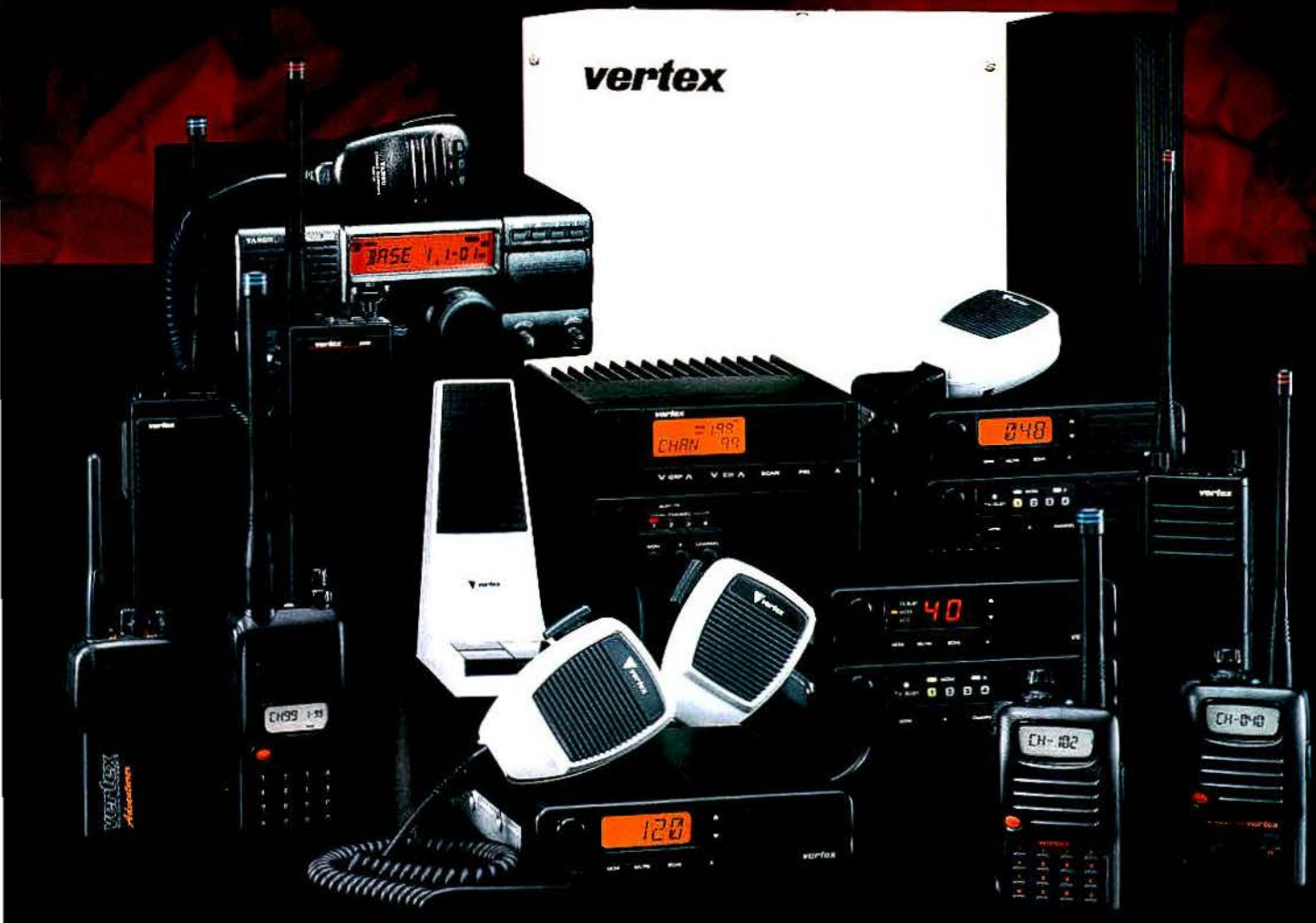

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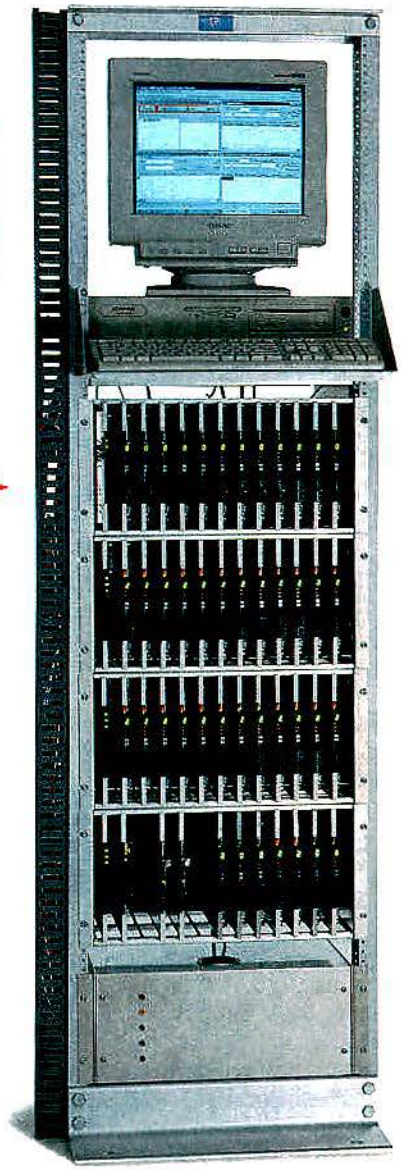

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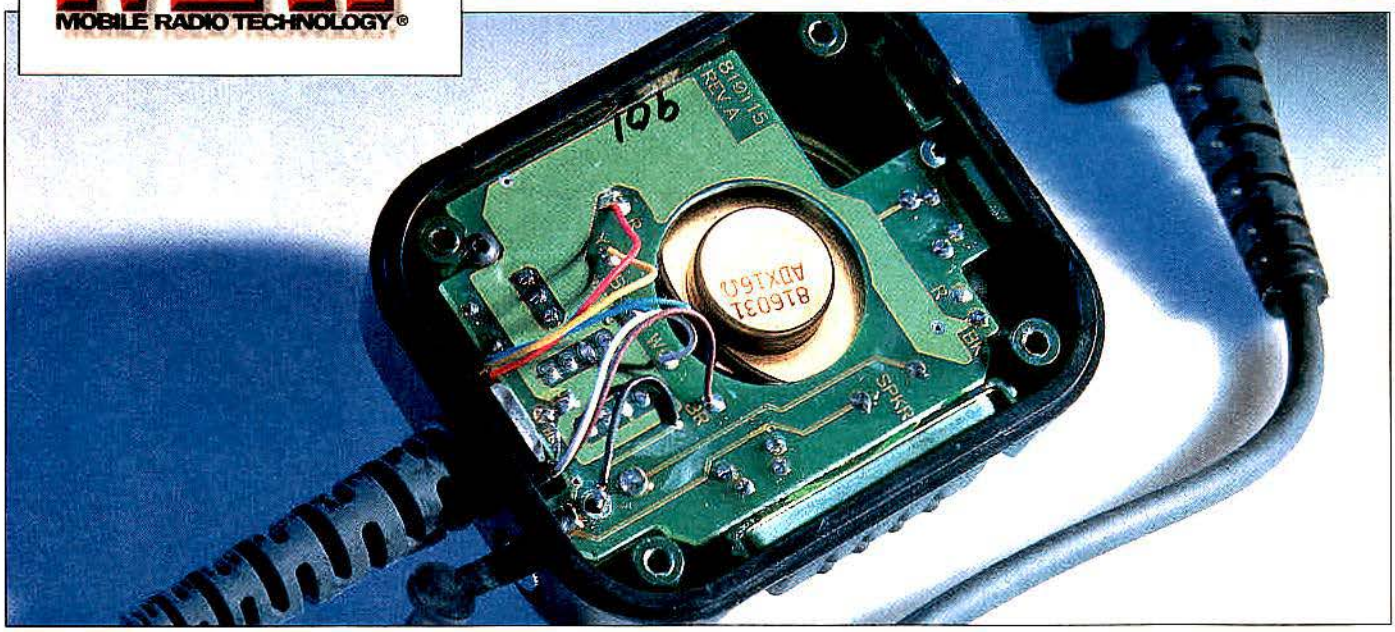
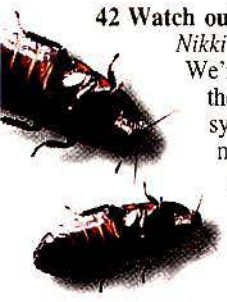


On the cover: Efforts to improve hand mic technology are driven by environmental needs and application-specific acoustics. See cover story on page 18. *Cover design by Scott Dolash, art director. Photography by Al Pitzner. Remote speaker-mic diagram courtesy of Otto Engineering, Carpentersville, IL. Otto mic courtesy of AF CommSupply, Overland Park, KS.*

features



departments

Vol. 17, Issue 7. Mobile Radio Technology (ISSN 0745-7626) is published monthly by Intertec Publishing, 9800 Metcalf Ave., Overland Park, KS 66212-2215, and is mailed for free to qualified subscribers within the United States and Canada. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post Publications Mail (Canadian Distribution) Sales Agreement No. 0956309.
POSTMASTER: Send address changes to Mobile Radio Technology, P.O. Box 12960, Overland Park, KS 66282-2960.
SUBSCRIPTIONS: Non-qualified subscribers may subscribe at the following rates: United States and Canada: one-year: $35. Qualified and non-qualified subscribers in all other countries; one-year: $45 (surface mail); $105 (air mail). Subscription information: P.O. Box 12960, Overland Park, KS, 66282-2960.

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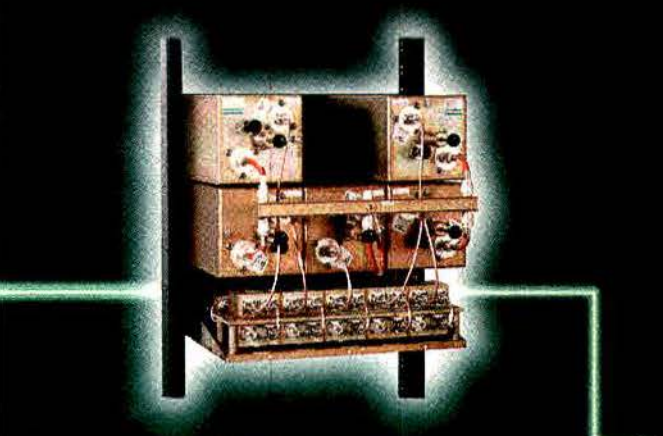

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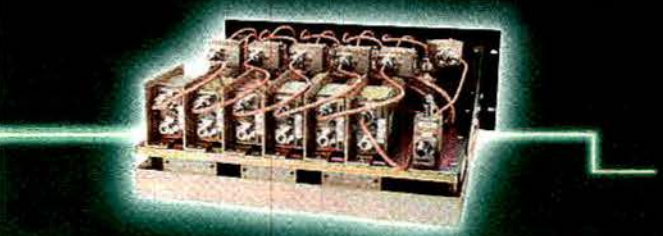

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See no evil, hear no evil, email no evil

Wow. Does it pay to be careful with email? You betcha.

Despite policies about not sending exchanging personal email on government- and company-owned computers, people do. We see it in our company. You see it in yours.

Aside from personal email being a mostly minor misuse of resources (both the time and the equipment) if the email gets passed along to the wrong person, it can be embarrassing. And if it gets passed along to a *lot* of the wrong people, it can be *really* embarrassing.

Case in point:

An FCC employee received personal email from outside the agency. The content was a joke. Um, okay, a filthy joke. With possible religious prejudice. (An FCC official later described the joke as "highly offensive.")

Whether the FCC employee forwarded the joke to others herself, or if someone else did it, is unclear from the email record, but somehow it was forwarded to everyone on the email subscription list for the FCC's *Daily Digest*. The *Digest* lists official actions taken by the FCC every day. About 6,000 people subscribe.

After becoming aware of the error, the employee to whom the joke originally was addressed sent an apology to *Digest* subscribers. And after the mistake drew official attention, the director of the office of public affairs sent an apology, too. She said that disciplinary action had been taken, but she didn't say what action or against whom.

So. What have we learned? First, when *Digest* email is brief, it is suspect. (Hardly anything official that the FCC sends is brief. It's a busy agency.) Second, when it is offensive, it might be about auctioning private radio spectrum. Third, when it is brief, offensive and *funny*, then it might be ... "inappropriate email" (the director's words). The FCC does not use humor in the *Digest*.

Anyway, let that be a lesson to all. Be careful when you forward email. And don't expect anything that unusual (or entertaining or disgusting, depending on your inclination) from the *Digest* again, for a while.

Postscript—another time, another technology: Linda Ellerbee, a former NBC-TV correspondent and "news brief" anchor and a current (I believe) host on a PBS children's series, once worked for a news wire service in Texas. One day, she used a teletype terminal to write a letter to a friend, intending to print the text and mail it. (Remember postal mail?) She pressed the wrong key and sent the letter, which included a stinging criticism of her boss, to wire service subscribers statewide. Her boss fired her, but the news director at one of

the TV stations that received the errant correspondence liked her writing and hired Ellerbee, beginning her career in television.

As for those responsible for the joke? Careers in comedy? Or pornography?

* * *

People are being careful about what they say—publicly—regarding radio interference received by 800MHz analog trunked systems operated in the vicinity of Nextel's 800MHz digital trunked systems.

For example, "IM/EMI Issues: A Conflict of Public Interest" by Joe Kuran in the March issue describes how an analog 800MHz system operated by the Washington County Consolidated Communications Agency (WCCCA) receives interference from an "integrated digital enhanced network" (IDEN) 800MHz system operated by Nextel. Both systems apparently operate within terms of their FCC licenses. Both systems use equipment made by Motorola that apparently functions within specifications.

Privately, people are drawing their own conclusions about where blame ought to be properly placed, whether on:

- ❑ the FCC for the band plan.
- ❑ Nextel for its base station positioning.
- ❑ Nextel for alleged transmitter noise.
- ❑ Motorola for its transmitters.
- ❑ Motorola for its receivers.
- ❑ WCCCA for using receivers with inadequate adjacent channel rejection.

The first stop in an analysis is to find whether emissions from IDEN transmitters are confined within the FCC-defined emission mask. Most people say it is, but is it? One expert said that the 10-year-old IDEN technology uses the best power control and linearization circuits that were available when they were designed, but that they cannot activate instantly as the transmitter keys. The result is a spreading of the signal so briefly that, although it may exceed the mask, a spectrum analyzer cannot detect it. Although this spreading may be a factor, the bigger part of the problem might be found in the receiver.

Although the FCC regulates transmitter emissions, it doesn't regulate receiver selectivity. Part of the cost of 800MHz equipment pays for receiver design, components and manufacturing. Price competition leads to cost reduction. Through the years, this has meant a reduction of receiver selectivity by some manufacturers so they can post more competitive prices.

So what are the choices?

1. Ask Motorola to apply updated circuitry to control transmitter power and linearization to reduce noise as the transmitter is keyed—and be prepared to pay the price.

2. Ask Motorola to make more selective receivers—and be prepared to pay the price.

3. Apply frequency coordination to adjacent channels, in effect requiring Nextel or public safety agencies or both to abandon otherwise available frequencies.

Do you have some to add to the list?

—don_bishop@intertec.com

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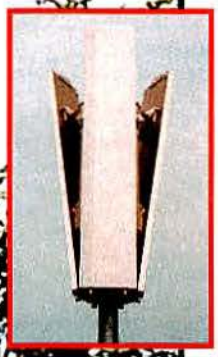

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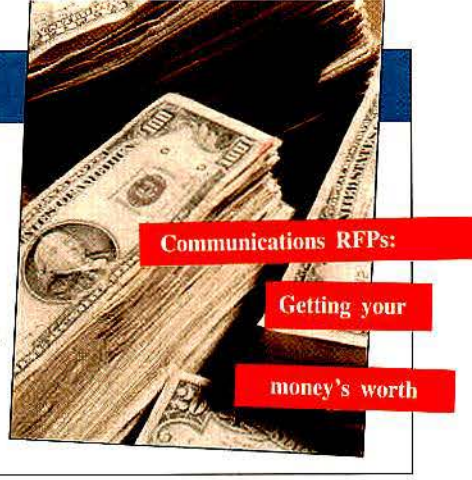
NEXT MONTH – AUGUST 1999

FEATURES AND NEWS: Computer-aided dispatch; fire radio and data; APCO preview and guide.

PLUS: Robert H. Schwaninger Jr.'s "In the Public Interest"; Don Bishop's editorial; product focus: logging and recording systems.

AND IN THE MONTHS TO COME: Railroad communications; the changing face of paging; system upgrades; location technologies; test equipment; hand-held radios focus.



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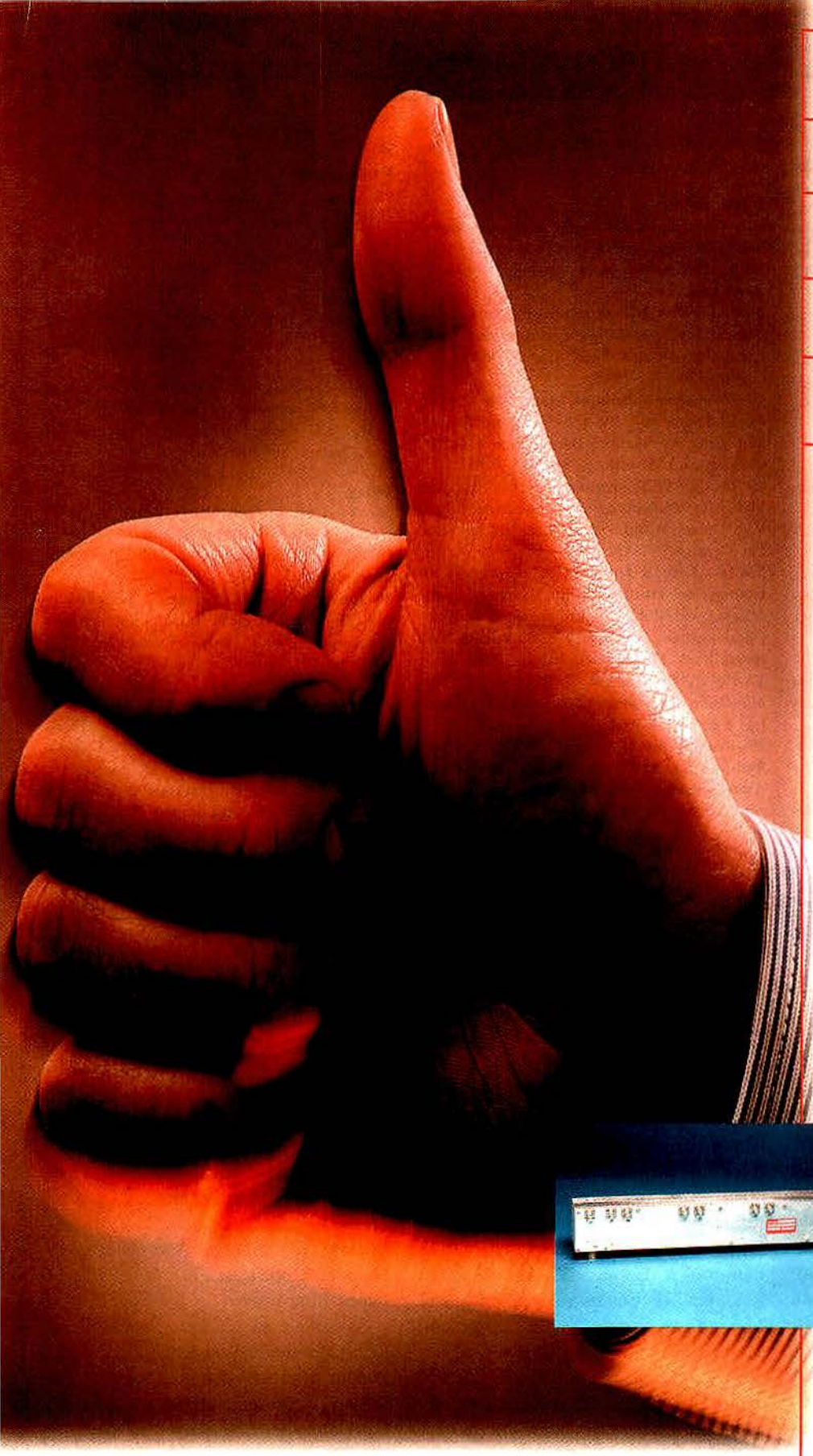

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calendar

July

14–16—Communications Expo/Show of the Americas, Miami Beach Convention Center, Miami. Contact: Jackie Gonzales, 305-412-9000.

26–28—Telecommunications Resellers Association Summer Carrier Forum, Westin Harbor Castle, Toronto, Ontario Canada. Contact: 202-835-9898.

August

8–12—Association of Public-Safety Communications Officials—International (APCO) National Conference, Minneapolis. Contact: 904-322-2500.

September

19–22—Fall Vehicular Technology Conference, sponsored by IEEE Vehicular Technology Society. Amsterdam, The Netherlands. Contact: 904-322-2500.

23-25—Personal Communication Showcase, sponsored by Personal Communications Industry Association, New Orleans. Contact: 703-739-0300.

October

2–4—Wireless I.T. '99, sponsored by the Cellular Telecommunications Industry Association, Santa Clara, CA. Contact: 202-785-2842.

18–21—Annual APCO Canada Conference, sponsored by APCO, New Brunswick Canada. Contact: Jim Flanagan 888-CANAPCO.

27–30—Industrial Telecommunication Association/USMSS joint Conference, sponsored by ITA and USMSS. Grand Hyatt, Washington, DC. Contact: 703-528-5115.

November

1–4—Telecommunications Resellers Assocation Fall Conference and Exposition, sponsored by TRA, Dallas. Contact: 202-835-9898 or www.tra.org.

2–4—Wireless I.T., sponsored by the Cellular Telecommunications Industry Association, Santa Clara Convention Center, Silicon Valley, CA. Contact: 202-785-2842.

10–14—Communications Marketing Conference, sponsored by the Communications Marketing Association, Harvey Hotel, Dallas. Contact: Jack Armstrong, 410-628-9300.

15–16—AMTEX, sponsored by the American Mobile Telecommunications Association, Hilton, Walt Disney World Village, Lake Buena Vista, FL. Contact: 202-331-7773.

15–16—Fourth Internatioal Congress on Commerical Trunked Radio, sponsored by the International Mobile Telecommunications Association, Hilton, Walt Disney World Village, Lake Buena Vista, FL. Contact: 202-331-7773.

17–19—TelecomLatina, co-sponsored by *Mobile Radio Technology*, Miami Beach Convention Center, Miami. Contact: 800-288-8606.

19—Radio Club of America Communications Symposium, 91st Anniversary Dinner and Awards Presentation, New York Athletic Club, New York. Contact: Gerri Hopkins, 732-842-5070.

2000

February

28–March 1—Wireless 2000, sponsored by the Cellular Telecommunications Industry Association, Ernest Morial Convention Center, New Orleans. Contact: 202-785-0081.

March

19–22—ENTELEC 2000, sponsored by ENTELEC, Dallas Convention Center, Dallas. Contact: 281-357-8700.

22–24—International Wireless Communications Expo, co-sponsored by *Mobile Radio Technology*, Las Vegas Convention Center, Las Vegas. Contact: 800-288-8606.

May

8–11—Telecommunications Resellers Association Spring Conference and Exposition, Philadelphia Marriott. Contact: 202-835-9898 or www.tra.org.

30–June 1—Canadian Wireless, sponsored by the Canadian Wireless Telecommunications Assocation, Toronto, Canada. Contact: 613-233-4888, ext 102, or www.cwta.ca.

June

4–8—Supercomm, sponsored by TIA and USTA, Georgia World Congress Center, Atlanta. Contact: 800-278-7372.

25–29—UTC Telecom, sponsored by UTC, The Telecommunications Organization, Phoenix. Contact: 202-857-1881.

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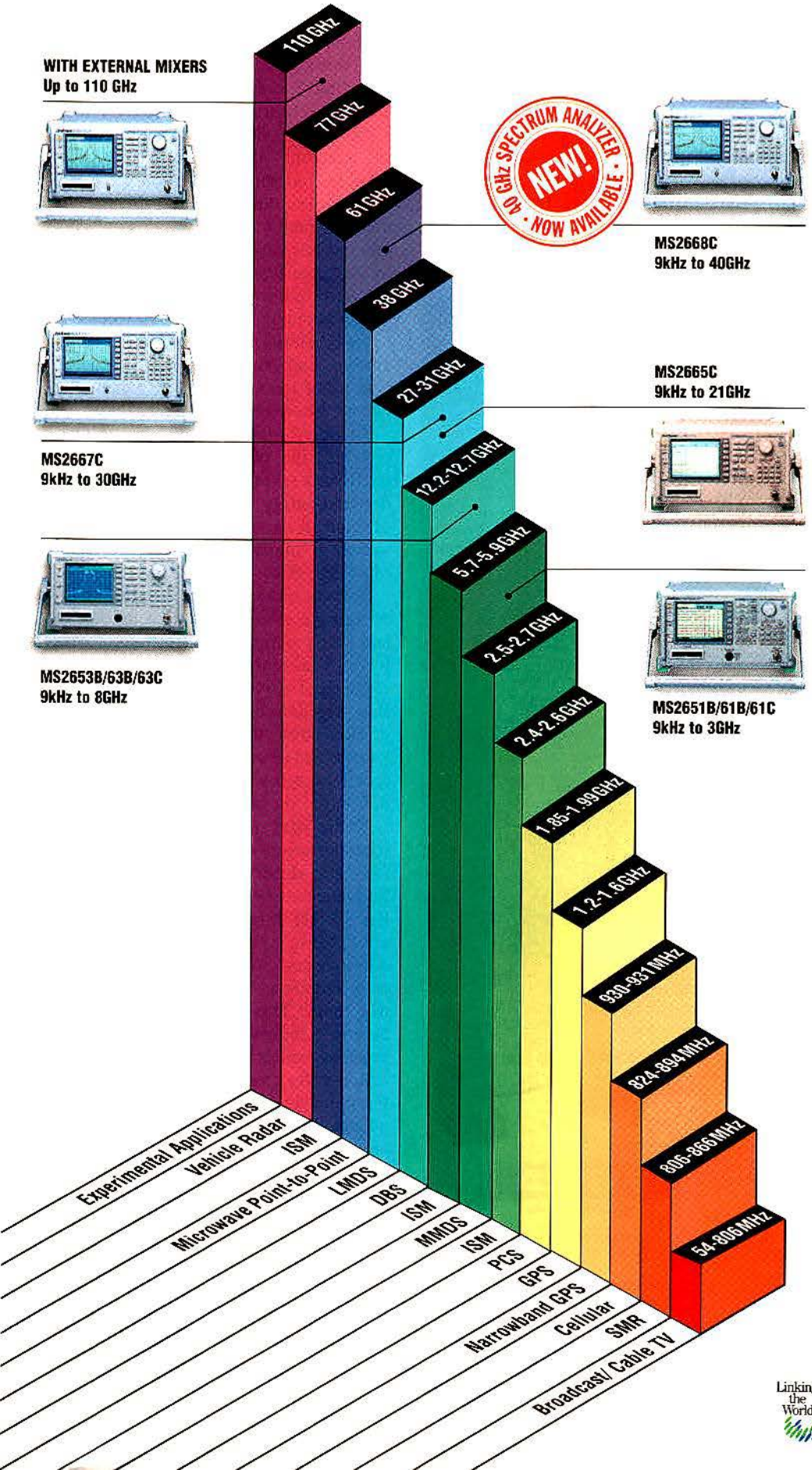

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Circle (8) on Fast Fact Card

Elementary—not secondary

For two months, microphone-toting and keyboard-pounding pundits have linked their own agendas to the tragedies in Littleton, CO, and other U.S. cities. Many have stretched to connect the shootings to content relevant to their listeners or readers. School shootings aren't our editorial focus, either, but they do draw attention to challenges within the radio industry, such as interoperable public safety emergency communications. They also create an appropriate moment to question how school district communications are prioritized and to remind private radio to be a good RF neighbor to schools.

Major issues face school radio: faulty coordination, hazardous interference and vulnerability to auctions under NPRM 99-87. Sometimes, more powerful stations are licensed too near schools, geographically or on the band, effectively blocking schools' use of their channels. Co-channel users have ordered bus drivers to get off the radio in language that shouldn't spew out of a mobile radio on a kindergarten bus. Vague language in the NPRM threatens schools' status as small governmental entities and could cast them into the bear pit of spectrum auctions when they can't even afford fresh chalk.

Aside from the recent aberrations, consider the typical, radio-dependent challenges schools face: maintaining order and safety at sporting events and off-campus excursions, staff and student security, maintenance and physical plant activities—and transportation.

Schools must not only meet the needs of average students but also the health and safety obligations thrust upon them by entitlements, mainstreaming of challenged students, the ADA, OSHA, state legislatures, the U.S. Department of Education, the NEA and God only knows who else. Protected spectrum for fixed-location activities is non-debatable; on buses, it's a no-brainer.

Some may argue that any public transportation—bus, train, light rail, taxicab—deserves equally protected frequencies to ensure passenger safety. Except that those passengers assume an acceptable risk and *choose* those conveyances. School buses are *assigned* transportation—the kids don't elect to use them. This creates liabilities for busing vendors and school districts, most of which (outside of 90210) are strapped for cash. None would hesitate through a 15-minute recess to subrogate a legal claim for a student injury against any business whose radio procedures might have delayed response to that incident. If the schools don't think of it, you can bet your yagi their lawyers will.

Auto clubs and other entities argue that they, too, deserve public safety/public service exemptions. Maybe so, but let's take care of the schools *first*, and *then* worry about stranded motorists.

—David Keckler
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Circle (10) on Fast Fact Card

800MHz interference poses problem

In "IM/EMI Issues: A Conflict of Public Interest," (March 1999) author Joe Kuran astutely noted that interference by 800MHz systems prior to ESMR systems was not a problem. But with the FCC's adoption of the First Report and Order (FCC 95-501 Dec. 15, 1995) and Memorandum Opinion and Order on Reconsideration (FCC 97-224 June 23, 1997) in the PR Docket No. 93-144 (ESMR) proceeding, interference to public safety systems has exponentially increased. Public safety, and in particular, Region-20 public safety, attempted to address this very issue with the FCC back in PR Docket No. 93-60, which dealt with future short-spacing protection criteria for systems operating in the 800MHz band.

On May 28, 1993, Region-20 filed a 594-page set of comments to PR Docket No. 93-60. In these comments, Region-20 submitted elaborate technical data and analysis to show that future commercial SMR/ESMR short-spacing against existing 800MHz public safety systems using a 40/22dBu d/u protection criteria would cause deleterious harmful interference to public safety.

Post Reply Comment period closure, Region-20 representatives conducted an oral *ex parte* presentation with the then Chief and Deputy Chief of the Private Radio Bureau Ralph Haller and Beverly Baker. At this meeting, extensive discussions were undertaken regarding the proposed insufficient protection criteria for future SMR/ESMR systems short-spaced against existing 800MHz public safety systems and our 594-page comments submitted to the proceeding substantiating this viewpoint.

At the conclusion of our meeting, Haller and Baker both seemingly concurred that the proposed 40/22dBu d/u protection criteria was insufficient to protect existing 800MHz public safety systems from future SMR/ESMR systems. However, they also noted that Region-20's counter proposal of a 40/5dBu d/u was too conservative. A compromise position of around 40/17dBu d/u short-spacing protection criteria to existing 800MHz public safety systems was reached.

But when the Report and Order in PR Docket No. 93-60 (FCC 93-450 Sept. 22, 1993) was adopted, the FCC essentially reneged on the understanding it had given to Region-20 and adopted their proposed 40/22dBu d/u short-spacing for all 800MHz systems on the basis that a 40/22 dBu d/u protection criteria "will provide reasonable protection from co-channel interference and, at the same time, provide for efficient re-use of this valuable spectrum" (R & O, par. 7), clearly implying that the commercial profitability from the use of this spectrum was more important than public safety interests and concerns. As a result, the entire country is now experiencing that exponential increase in interference to 800MHz public safety systems by short-spaced ESMRs as predicted by Region-20.

Though I respect the effort Congress is making to address the issue in H.R. 4813, it falls under the saying, "A little too late." As far as I am concerned, it will take "an act of God" to retroactively enforce increased short-spacing protection criteria upon ESMR systems. Prospectively, public safety entities are being forced onto the 700MHz and 821MHz public safety bands to overcome this problem, a problem that should never have been allowed to occur in the first place.

—Michael C. Trahos
Alexandria, VA

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800MHz relocation: It's about leverage

By Robert H. Schwaninger Jr.

To prepare for the possible relocation of your use of the upper 200 SMR channels, the first step is to put the matter in perspective. This is a *contract* negotiation. It is *not* an engineering problem or an RF design problem. It cannot be solved with a few crystals and a screwdriver.

Because it's a contract negotiation, you should first note who has the leverage in the negotiation. The answer is the site-based licensee. That primacy was made a portion of the FCC orders granting relocation authority to EA licensees. They got the authority, and incumbents got the leverage. Put another way, EA licensees have all of the obligations to make relocation work under the FCC requirements. Site-based licensees only have to be reasonable and cooperative. The FCC never said that saying "no" to unreasonable demands and terms from an EA licensee was an unacceptable option.

Preliminary matters

To get ready to talk to an EA licensee about relocation, I suggest you do a little reading. Start by looking over the FCC's decisions: Memorandum Opinion and Order, FCC 97-244, PR Docket 93-144 (July 10, 1997) and the First Report and Order, Eighth Report and Order and Second Further Notice of Proposed Rulemaking, FCC 95-501 (Dec. 15, 1995).

Until you read the FCC's decisions and formulate a strategy, politely accept notification from the EA licensee, but don't be filling out forms, schedules, lists, etc being circulated by companies like Nextel Communications. The information requested on those forms is *proprietary*, not required to be given or simply requested prematurely.

After you read the FCC's orders carefully, apply the stated requirements for EA licensees to your system. That is, see what the EA licensee would be required to do to relocate your channels in strict accord with the FCC rules. You can always reduce your demands, but as with all contract negotiations, know where the edge of the envelope is.

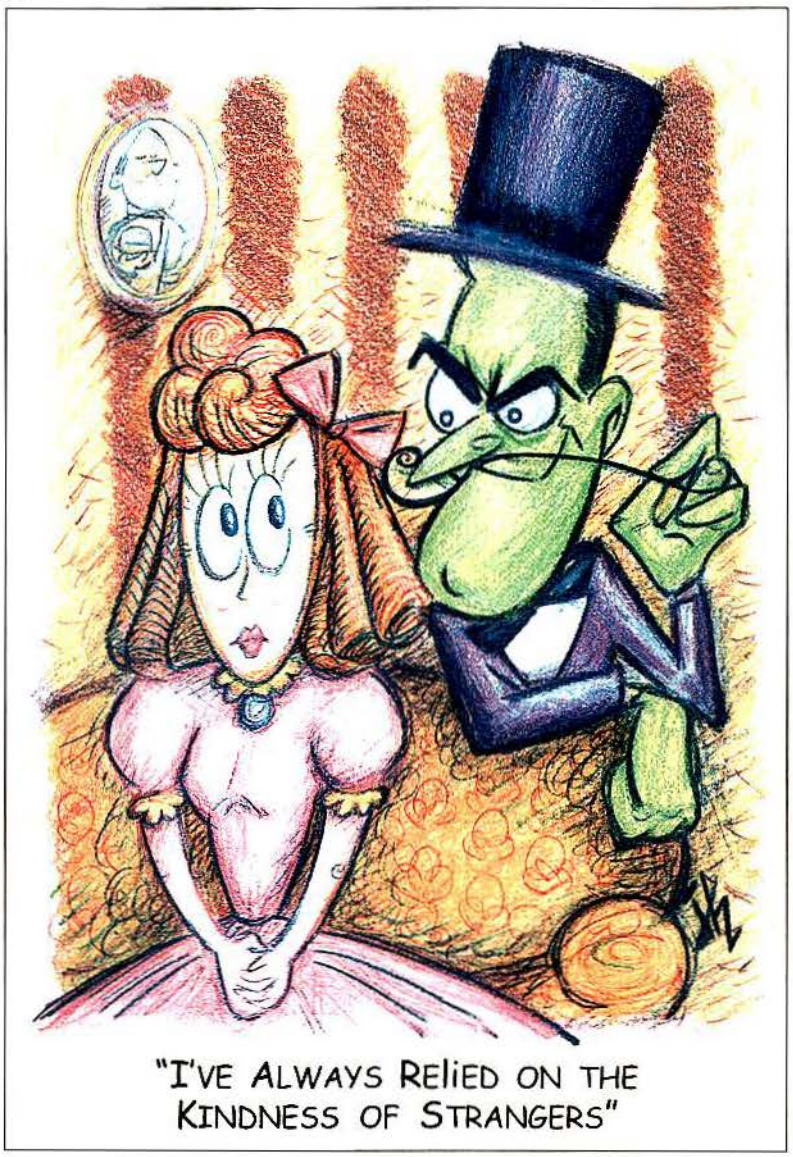

Illustration by John Hayes

The first draft

After getting up to speed, you are going to find out that EA licensees must comply with myriad obligations and agree to bear a number of costs to demonstrate the ability to engage in relocation. The length of this column doesn't permit a full recitation of those obligations. However, here are a few that you might look for in the first draft.

The EA licensee should agree to bear all costs of relocation, including hardware, software, design, installation, increased rents, legal, etc. EA licensees will try to flat-rate or cap these amounts. Because most licensees don't have a crystal ball, flat rating the amounts is silly. Therefore, negotiate a formula that will neither abuse the EA licensee nor leave you holding the bag.

The EA licensee must articulate a method for providing a "seamless" transition that avoids disruption of service. The FCC orders contemplate the construction of additional repeater facilities, that would be tested and tried prior to turning off the channels to be relocated. The EA licensee should be prepared to reduce to terms and warranties the way that the seamless transition will be accomplished and how the EA licensee will be able to perform.

The channels

As a preliminary matter prior to execution of an agreement with the EA licensee, you should ask which channels are being offered in exchange for your upper 200 channels. Then, using that in-

Schwaninger, *MRT*'s regulatory consultant, is the principal in the law firm of Schwaninger & Associates, Washington, which is general counsel to Small Business in Telecommunications. Schwaninger is also a member of the Radio Club of America.

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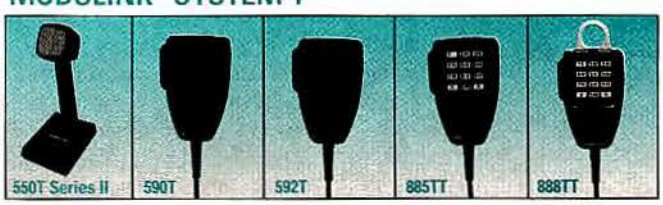

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formation perform a search of the FCC records to determine a number of factors, such as (1) whether the grant is under petition or objection; (2) whether any finder's preference targeting the channels is still pending; (3) the identity and location of any co-channel user; and (4) whether the FCC rules allow for relocating the channel to your location.

The last of those elements is quite important. Although the FCC has been clear in setting forth EA licensee's ability to engage, in relocation, the FCC has not significantly changed the rules for an EA licensee's operation of lower channels. That is, the EA licensee was supposed to have constructed, made operational and continued provisioning service from systems employing those channels in accordance with any extended implementation schedule granted, if applicable. Of greatest importance, the FCC has not granted greater "mobility" in relocation of those channels. Therefore, the EA licensee will have to show that the channel can be moved and operated *by you* at your location.

Remember that relocation is really just a partial assignment of licenses granted to the EA licensee. Following assignment, any special protections or privileges granted to the ESMR or EA licensee do not transfer to the site-based incumbent. Therefore, you must explore the licensing status of the channel before and after the assignment.

Customers

The contract should articulate the way that customer units will be retuned or replaced. I've heard that one significant EA licensee is trying to reduce its burden by stating "We'll pay *X* dollars per customer unit for retuning." Depending on *X*, that offer might be a reasonable start. But there is also the issue of "downtime" of the customer vehicle during the retuning period. Will your customer get the value of downtime from the EA licensee? They should.

When equipment is incapable of being retuned, the issue of replacement comes up. The contract should address this issue and assure that the quality of replacement equipment is adequate to satisfy customers.

General provisions

The contract to be negotiated between the parties can get quite complex, with an EA licensee providing a number of warranties. It can also be a simple matter, if you choose to simplify the process. But remember, the choice remains with the site-based incumbent licensees. They are entitled to have all terms, conditions, warranties, covenants and remedies spelled out in an agreement that demonstrates the EA licensee's duties. Like most things, it comes down to *trust*.

If you trust the EA licensee, then a simple agreement might fill the bill. If, however, you do not trust the EA licensee, you should protect your interests thoroughly by negotiating an agreement that speaks to each *who, what, where, when how* and *what-if* of relocation.

Despite what you might have heard, this is not a good situation to be rushed. Remember, if the EA licensee is unwilling or unable to provide seamless transition to comparable facilities and spectrum, the EA licensee is not entitled to force relocation. The burden is on the EA licensee to show the financial, regulatory and practical ability to engage in relocation. *The burden is not on site-based incumbents to show the contrary.*

Finally, despite claims to the contrary, there is no obligation to participate in binding arbitration. The matter is still before the FCC, and you can reasonably expect that this lawyer will keep telling the agency, "You started this, you finish it." ■

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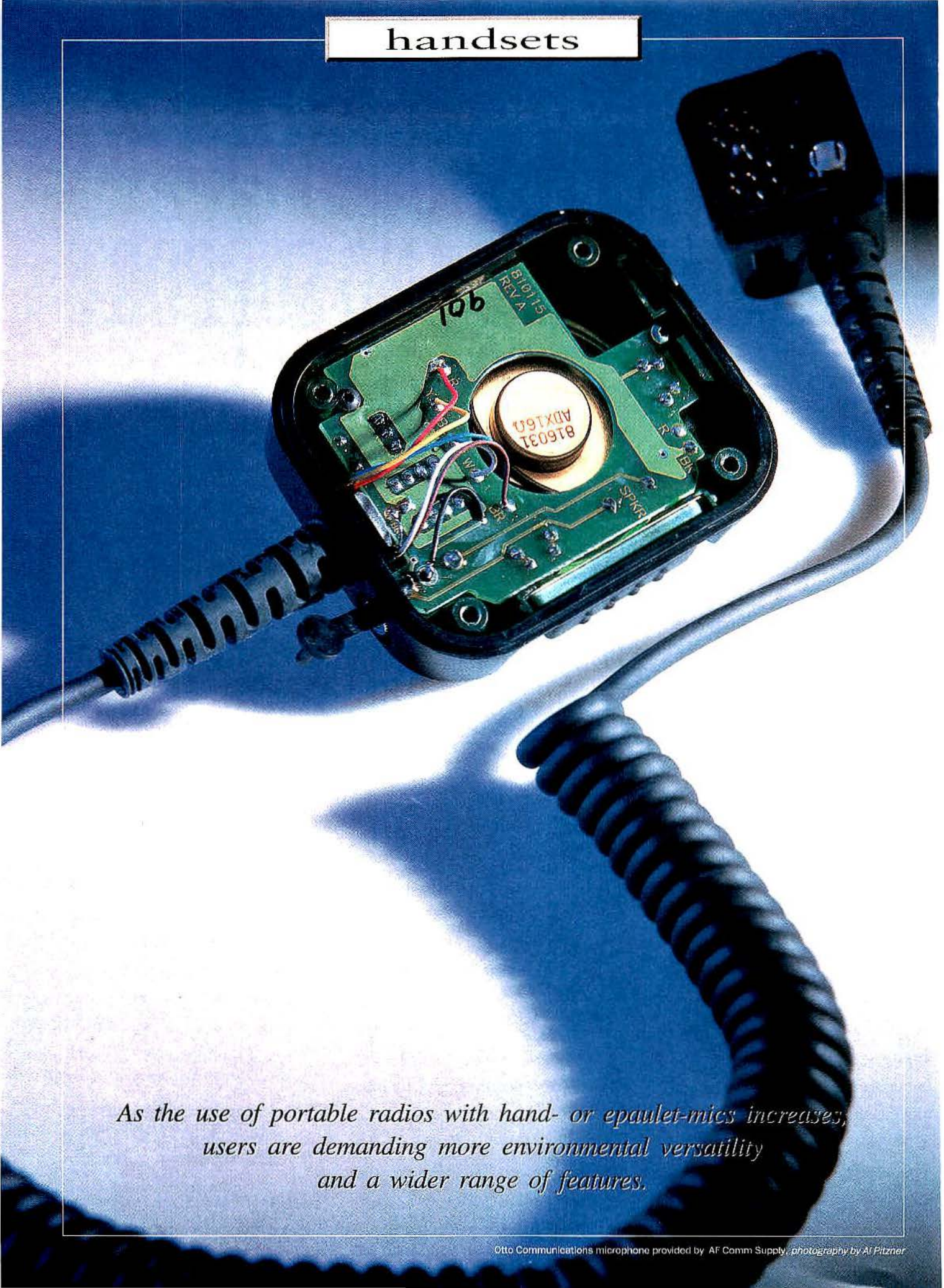


As the use of portable radios with hand- or epaulet-mics increases, users are demanding more environmental versatility and a wider range of features.

Otto Communications microphone provided by AF Comm Supply, photography by Al Pitzner

Improving microphone technology

By Michael J. Major

Personal microphones used by public safety patrol and response officers are expected to work reliably in extremes of environment: raging forest fires, driving hurricanes and bitter cold. Mics must filter out high-decibel noises ranging from rock concerts to gunfire. Moreover, they are expected to be immune to radio frequency interference (RFI) and electromagnetic interference (EMI) and to be compatible with "incompatible" radios.

The wonder is not that mics don't always work to satisfaction, but that they work at all.

These devices *have* worked tolerably well, often under adverse conditions. That is shown by their ubiquity. Public safety officials constantly rely on portable radio systems. This, in turn, has driven manufacturers to work harder to come up new equipment. A number of manufacturers work in this arena, producing good microphones, but each has a different approach. No single "silver bullet" can solve all of the acoustical design problems associated with personal mics.

The way Television Equipment Associates, Brewster, NY, deals with problems such as RFI, EMI and radio incompatibility is to customize each unit.

"Each problem must be dealt with on a case-by-base basis," said TEA Vice President Steve Tocidlowski.

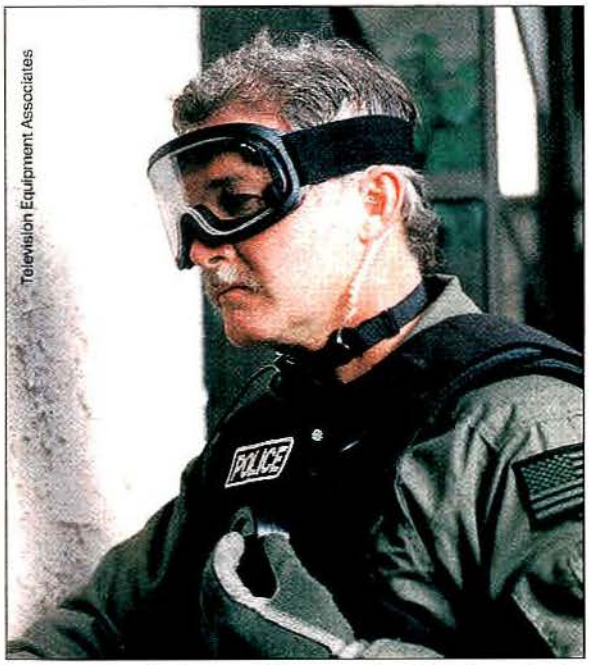
For instance, dynamic microphones are used for military-type applications and electret mics are used for others. Dynamic mics withstand rugged use and typically have low impedance and a good frequency response. A diaphragm fluctuates an attached coil in and out of a magnetic field, which induces electric currents in the coil. Low-distortion, high-frequency-response electret mics are similar to condenser-type mics, where a diaphram is attached to one plate of a capacitor, except that electrets do not need a bias voltage to create an electric field. Dynamic mics have to be amplified to simulate electret mics. Each mic type is prone to different types of interference.

Shielding, noise cancelling, RFI chokes and capacitors and multi-directional devices are different solutions that may be appropriate in one situation but not in another.

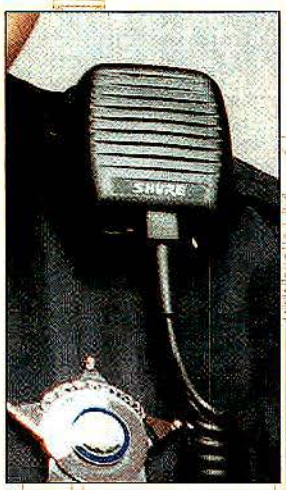
"The problems are not easily characterized, especially when the microphones are used in different environments," Tocidlowski said. "And RFI is a very mysterious phenomenon to deal with. You often have to proceed through trial-and-error. It's not as if you have an empty tire that you simply fill up with air." Shielding, noise canceling, RFI chokes and capacitors and multi-directional devices are different solutions that may be appropriate in one situation but not in another.

Tocidlowski said that TEA's mics had to be designed for different radios. "Each

Major is a communications writer based in Anacortes, WA.



Throat mics (below) and boom mics (right) are both popular for various environments and approaches in tactical situations.



Shure Brothers

Shure Brothers has a modular link series to solve the problem of microphone-to-radio incompatibility. The use of an appropriate module allows the user to plug into any radio without hardwiring. To meet the physical demands of public safety work, Shure microphones must pass 37 separate environmental tests, including exposure to extreme hot and cold temperatures, ultra-violet light, moisture and salt spray.

department generally tries to standardize its equipment, and as a manufacturer, we work with these interface problems," he said. "But it's also very common for public service departments to have more than one brand of radio—along with different models."

Evanston, IL-based Shure Brothers, on the other hand, has a modular link series to solve radio incompatibility. Applications Engineer Matt Waller said that Shure has a variety of port sets that can hook up to every radio.

"It's almost like a plug-and-play," Waller said, "Through the use of the appropriate module you can plug into any radio without the need of hard wiring."

Waller also said that modularity allowed a new cord to be added to a hand mic in seconds, avoiding downtime to send the cord and the mic to the repair shop, as is the case when the cord is hardwired to the mic.

"Cord failure is the single, biggest cause of microphone failure," Waller said. "This solution allows for the quickest resolution of this problem."

To meet the demands of ruggedness and reliability, Shure microphones must pass 37 environmental tests, Waller said, including exposure to extreme hot and cold temperatures, ultra-violet light, moisture and salt spray.

Gerald Bloom, president of Earmark, Hamden, CT, said that handling ambient noise was one of the design criteria for his company's products.

"We're a very specialized radio company and design only for environments others don't want to work in," Bloom said. "A few environments generate more noise that we can handle, but not many." He said that a front-to-back noise canceler erases, at a minimum, 12dB to 20dB and can be designed to cancel levels as high as 130dB.

The basic technology of enhancing the voice and filtering out unwanted sounds is well-known, Bloom said. The voice goes in one side while the other side cancels out the background noises. Bloom said that the geometry and design of the acoustic cavity, achieved through many years of research, has achieved a high level of efficiency.

Earmark has focused on fire and chemical hazard uses. The company offers a couple of options. One is an external mic that can hook onto the outside of a mask. The patented filtering device responds only to the human voice through special techniques involving nonlinear components used for differentiation. It acts as if the mask were not there. For use with SCBA equipment, like a

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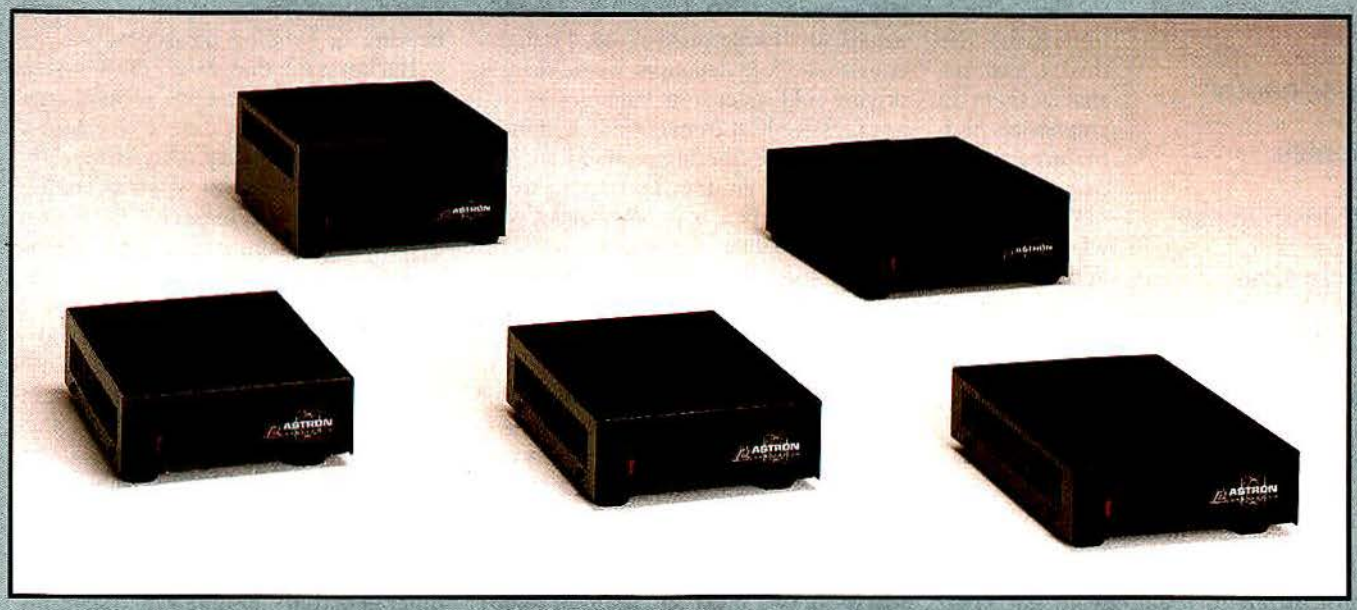

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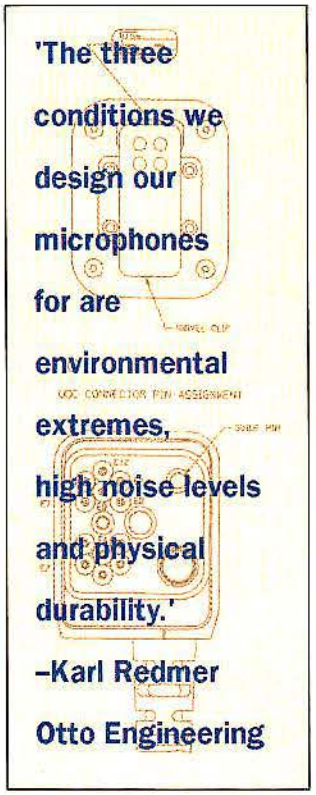

respirator, which hampers radio communication, Earmark uses the more traditional throat mic. This device picks up the low vibrations from the throat and reshapes them to emphasize high frequencies and cast off low frequencies, so what comes out approximates normal voice.

Karl Redmer, electrical engineering manager, Otto Communications, Carpentersville, IL, said that the growth of portable radio use had not only increased requirements for environmental durability but demands for more features as well, resulting in more buttons and attachments that make sealing the mic case more difficult.

Redmer said that his company's products go through intensive focus group discussion and beta testing. Two difficult applications being dealt with include sealing the microphones against conditions such as driving rain, or hurricanes, so the water is kept out, but the voice audio emerges as loudly as possible against the background noise. Firefighters also work in situations where there is driving cold water from the hoses as well as excessive heat from burning buildings.

These noise-filtering products are also designed for air transportation ground crews, which face both noise and a wide range of weather conditions.

"The three conditions we design our microphones for are environmental extremes, high noise levels and physical durability," Redmer said. "They have to withstand shock treatment, and the cable has to be very rugged and remain flexible when it's subjected to abuse, such as being caught in a fence during a chase."

Redmer added that each microphone requires different sealants. "You can't simply close all the openings," he said. Microphones must incorporate subtle differences of design so that they can interface effectively with more than 100 types of portable radios.

Motorola Land Mobile Products Sector, Schaumburg, IL, has also developed a product designed "for the public safety professional who is often in an environment where it is difficult to communicate effectively and privately," said Charles Backof Jr., vice president. "Sirens, crowd noise and speeding traffic can interfere with hearing or sending messages."

Backof said that Motorola's system enhances communications in loud environments while providing a "speak-in-a-whisper" capability. An integrated microphone/receiver system, called CommPort, fastens securely onto the ear. Some "skull mikes," which pick up bone vibration, often suffer intelligibility because spoken fricatives (such as in words pronounced with an "f" or "s" sound—"fire"or "system") are not sufficiently sounded. Backof said Motorola's mic instead picked up sound waves as they crossed the face, enhancing voice quality.

Gail Moody, Motorola marketing manager, said that the company had put a lot of effort into ergonomics. Customer surveys, she said, have demonstrated that "Users want these microphones to be comfortable enough so they can wear them through an entire shift." ■

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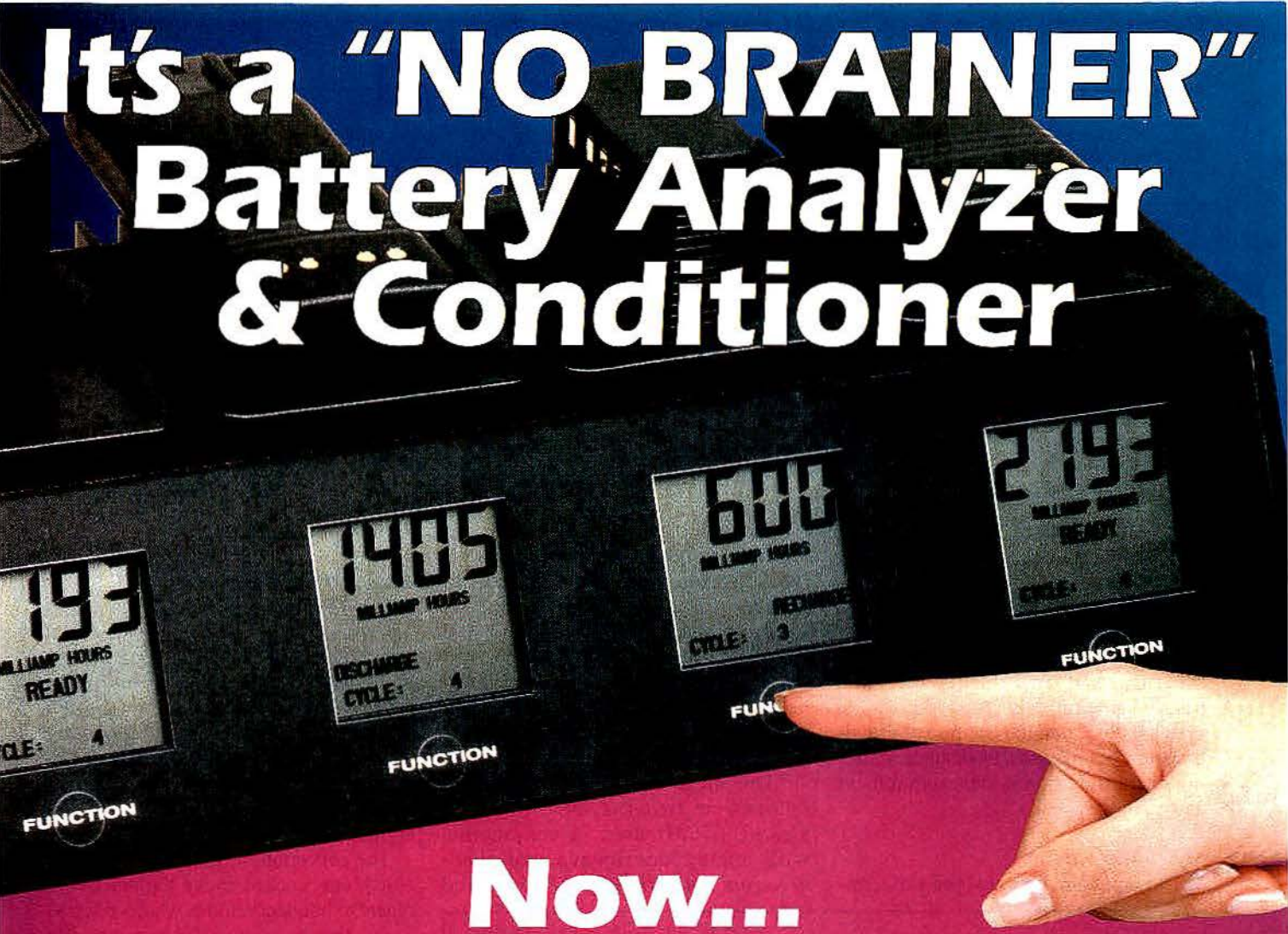

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Controlling base stations over microwave

New wireless applications have caused increased demand for base station and circuit transport equipment. Circuit voice frequency and signaling schemes are necessary in implementing any remote radio system controlled over microwave.

By Jeff Ashley

Remote-controlling two-way base stations has been commonplace for decades. Various radio system configurations demand differing control and transmission requirements. Microwave systems are a popular method of circuit transport but require a basic understanding of transmission systems equipment and practices.

Microwave radios

The input and output signals of a microwave radio are not directly compatible with discrete two-way radios. Microwave radios provide a method of transport for many circuits at a time—sometimes up to several thousand. The signals carried by the microwave system are a composite, containing information from all combined active circuits. The combining process is called *multiplexing*. (See Figure 1 below.)

The most common multiplexing schemes are *frequency-division multiplexing (FDM)* used in conjunction with analog microwave and *time-division multiplexing (TDM)* used with digital microwave.

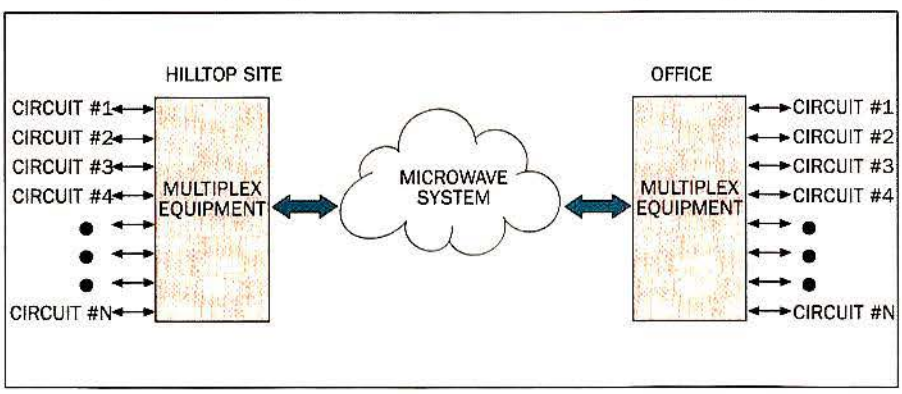

Figure 1. Individual circuits interface to the microwave system through multiplex equipment.

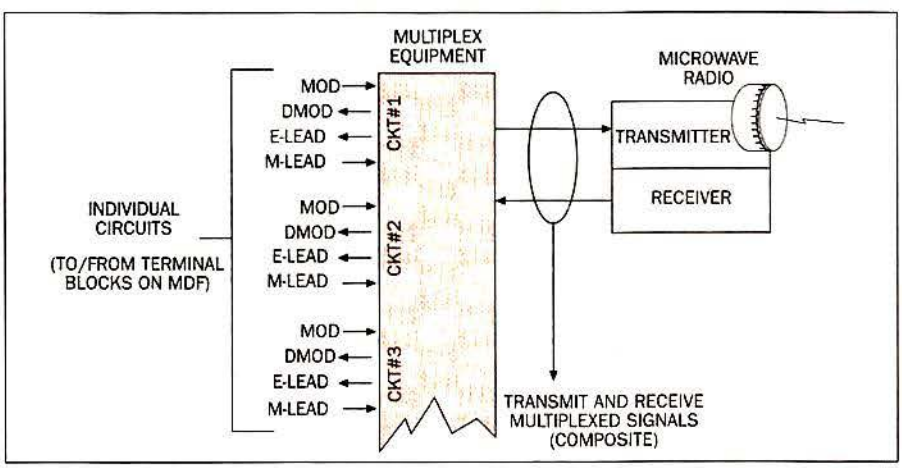

Figure 2. The voice frequency (VF) and signaling information for each circuit is multiplexed into a single, composite, four-wire signal.

Analog multiplex equipment

FDM equipment essentially slices up a portion of the HF frequency spectrum into a series of channel slots, each 4kHz wide. Every circuit in the multiplex (mux) system is assigned its own unique slot. Through the multiplexing process, translation and filtering methods convert each circuit into a single-sideband suppressed carrier (SSBSC) signal.

The collection of SSBSC signals (circuits), one stacked above the other with regard to frequency, forms what is referred to as the *baseband*. The composite baseband signal is applied to, and modulates, an FM microwave transmitter.

Although common carriers use analog microwave links that support thousands of circuits, industrial microwave applications typically do not carry more than 600 channels, and often fewer. Direct-to-line FDM equipment can be purchased on a per-channel basis to accommodate smaller systems in a cost-effective manner.

Digital multiplex equipment

TDM is a digital process that converts discrete circuits into a single serial bit stream. The most commonly used scheme in the United States is to convert 24 circuits into a 1.544Mbps data stream, referred to as a *T1*. Such a T1 multiplexer is often referred to as a *channel bank*. The composite 1.544Mbps signal allows each circuit a maximum data rate of 64kbps, which is considerably greater than what is required for voice and radio applications.

Currently, digital microwave radios can transport from as few as one T1 to

Ashley is a communications technician in Los Angeles.

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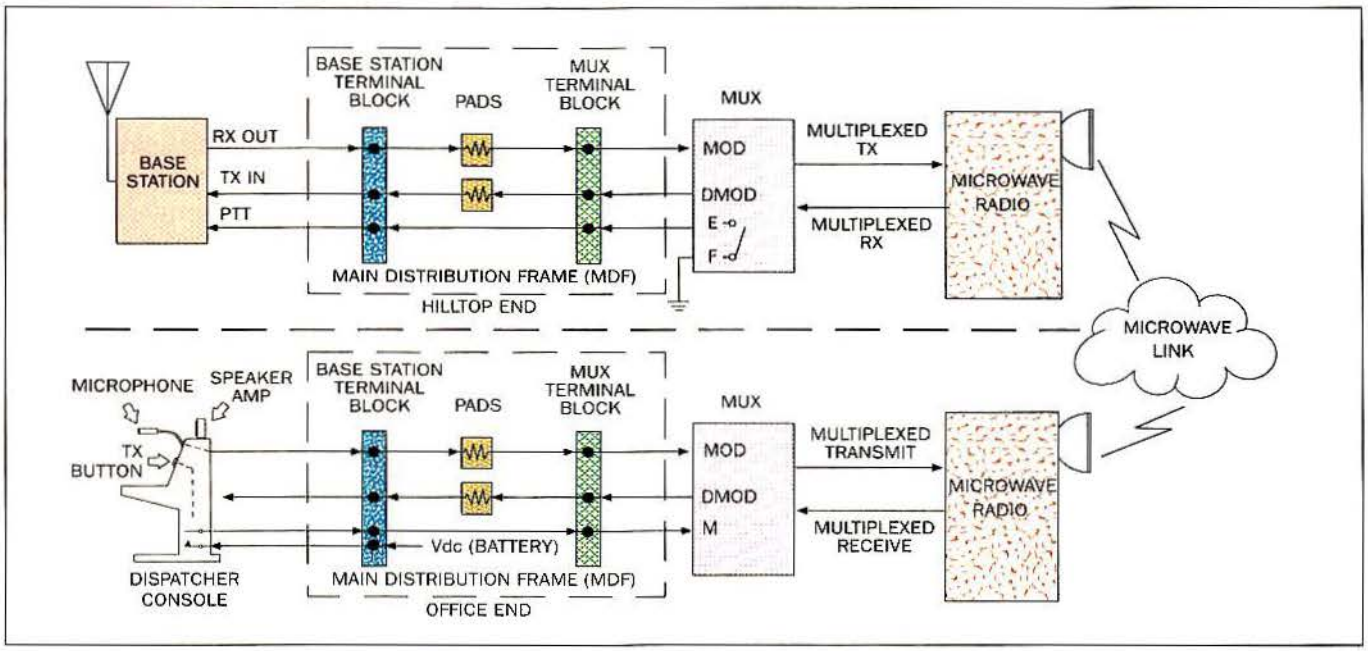

Figure 3. A typical remote base station circuit using four-wire, E & M mux.

more than a hundred. As the system capacity increases, so do the required microwave transmission data rate and bandwidth.

Voice frequencies (VF)

Whether the multiplexing scheme is FDM or TDM, a mux channel modem is required on both ends of each circuit. For radio applications, the modem is the point of termination for the base station on the hilltop, and the controlling equipment (such as a dispatch console) in the main office.

Each mux channel has a VF (audio) response of about 300Hz to 3,400Hz. The mux channel VF receive and transmit connections are referred to as the DMOD and MOD (respectively). They offer a balanced, 600Ω, two-wire (2W) or four-wire (4W) connection to the associated equipment.

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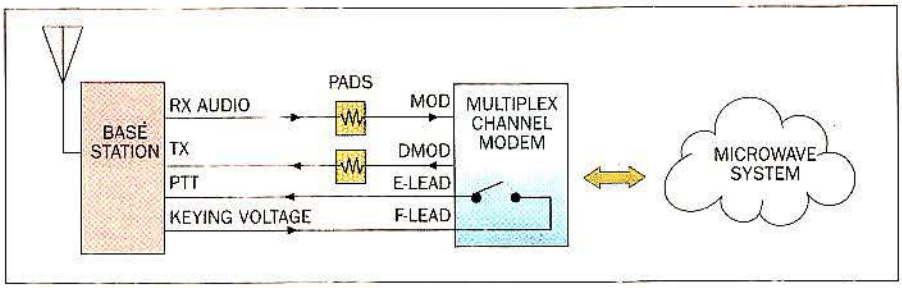

Figure 4. Occasionally, a base station application will require a specific internal keying voltage to be routed through the mux receive signaling leads.

means the transmit and receive functions are active at the same time. Used in conjunction with full-duplex base stations and user-end equipment, radiotelephone interconnect companies can provide customers with services that allow them to listen and to speak at the same time.

VF levels

Although mux modems operate over a wide range of VF levels, good engineering practice dictates that the maximum transmission level, referred to as *test tone level*, should not be exceeded. Test tone level at the DMOD and MOD of the mux modem are +7dBm and −16dBm, respectively.

Excessive levels are a greater consideration with analog mux and microwave equipment because much of the signal processing requires circuitry to be operating in a linear mode. When levels become excessive, circuitry can be driven into non-linear operation, resulting in intermodulation distortion.

Transmission systems engineers often use the term *dBm0* to express the power level of a signal at a particular point in a circuit, referenced to test tone level. For example, if a tone level of 0dBm is measured at the mux channel DMOD, the level can be expressed as either 7dB below test tone level, or just simply −7dBm0. (Remember, test tone level at the DMOD is +7dBm.)

The VF levels of each mux channel modem can be altered by means of variable receive and transmit gain adjustments or internal pad strapping options. For the sake of standardization, mux levels are often set identically for each circuit within the *same application* (i.e., all radio circuits may be operated at −10dBm0 while all data circuits operate at −13dBm0, etc.). In such cases, any level variations required by different equipment within the same application are accommodated by the use of *external pads*.

Signaling

Most circuit applications also require the transmission and reception of supervisory information to perform a particular function related to circuit operation. In a phone circuit, supervisory information may indicate an off-hook condition to the central office, while in a radio circuit, it may activate a transmitter. The transmission and reception of supervisory information within a circuit is achieved by means of *signaling*.

In-band signaling is accomplished by use of one or more frequency specific tones that fall within the VF passband of the mux channel. Presence or absence of a particular tone frequency within the circuit activates or deactivates the needed function. For example, tone remote base stations use a specific in-band tone signaling scheme that can

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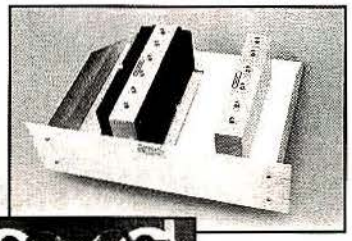

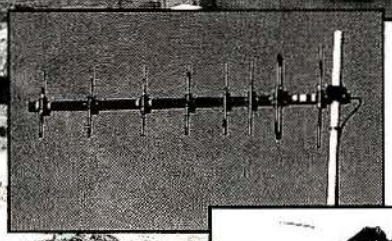

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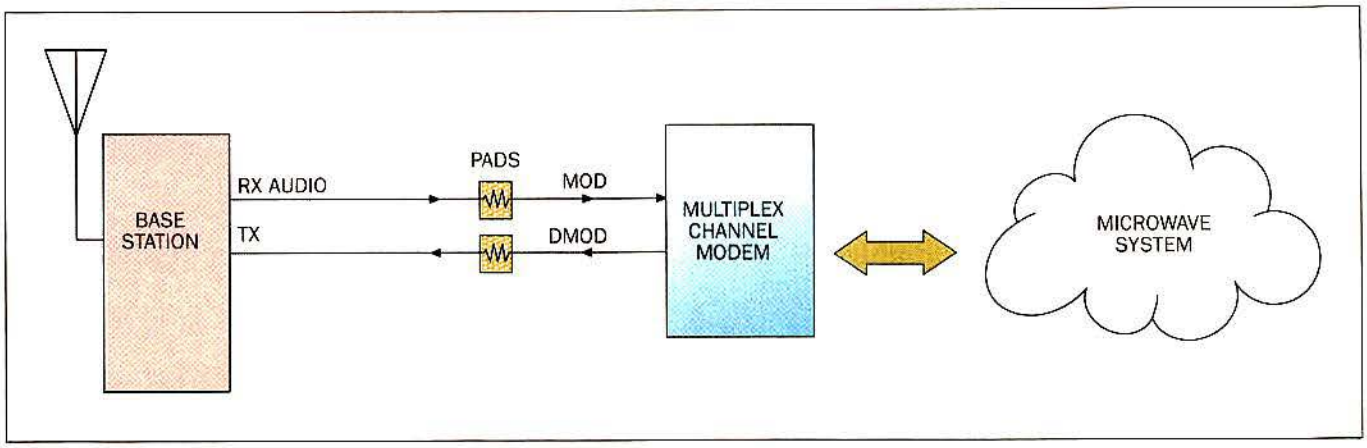

Figure 5. In-band signaling schemes do not require the use of mux channels E- and M-leads.

activate a transmitter, change operating channels and disable receive CTCSS decoder functions.

Out-of-band signaling is achieved by transmitting and receiving supervisory information over the circuit, but from outside the normal VF passband. In FDM systems, out-of-band signaling is accomplished by insertion of a signal on either the edge of the channel's frequency slot or within the slot but outside the VF passband (such as a 3,825Hz tone). Presence or absence of the signal determines the state of the supervisory function. In TDM systems, signaling is determined by the logic state of dedicated signaling bits.

Whether analog or digital mux is used, a mux modem has two primary connections dedicated for signaling functions. These are referred to as the *E-lead* and the *M-lead*. The M-lead is the transmit signaling lead. When the mux modem M-lead is activated, signaling is transmitted to the far-end of the circuit. Reception of the far-end M-lead activates the local E-lead. Digital mux has the capability of providing two E- and M-leads, which proves to be advantageous in certain applications, as shown in Figure 8 on page 36.

Main distribution frame (MDF)

The VF and E- and M-lead connections from each circuit are cabled from the mux equipment rack to terminal blocks, typically located on the inside wall of the site. Most signal-carrying site equipment (including any external pads) is cabled to the same general location. The collection of all equipment terminal blocks can then be found in the same portion of the building, on the same wall and is referred to as the *main distribution frame (MDF)*. With all

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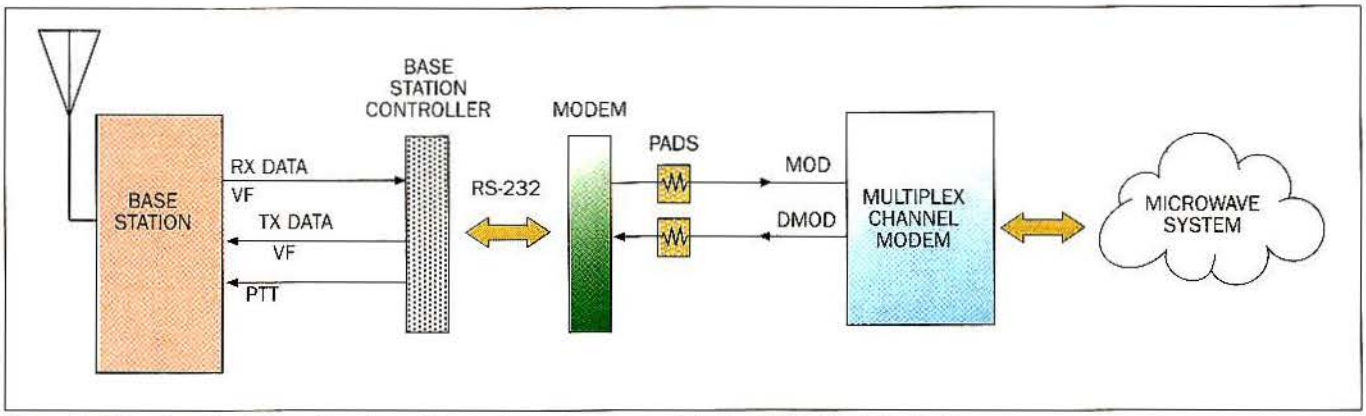

Figure 6. The signaling information in a data radio system is contained within the data itself.

equipment signal connections available in one location, jumpers (referred to as cross-connects) can be made from one piece of equipment to another by connecting wires between the respective blocks. In this manner, the mux channels are cross-connected to their respective pads and base stations.

Multiplexed signal connections

FDM systems require coaxial cables to carry the multiplexed receive and transmit *baseband* signals between the multiplex equipment and the microwave radio.

On the other hand, T1 signals can use inexpensive telephone wire (twisted pair). (See Figure 2 on page 24.) Cable specifically designed for higher data rate applications, such as Category V, allow spanning of greater distances between the mux and microwave equipment. It is a good practice to have the transmit and receive pairs on separate cables, or at least in separate bundles if the same cable is used.

Practical applications

Figure 3 on page 26 offers an example of a remote-controlled base station using E- and M-lead signaling. Here, the dispatcher can press a button on the console to key the hilltop transmitter. The button causes switch contacts to close routing battery voltage to the mux channel M-lead. Activation of the M-lead is detected on the hilltop end, causing a contact closure of the hilltop mux channel E-lead relay. The E-lead relay contacts apply a ground to the base station PTT line, keying the transmitter.

As the dispatcher speaks into the microphone, voice audio leaves the console and, after appropriate padding, is applied to the mux channel MOD. The voice is recovered on the hilltop-end from the mux channel DMOD and then

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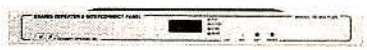

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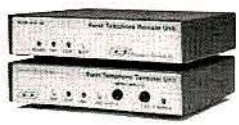

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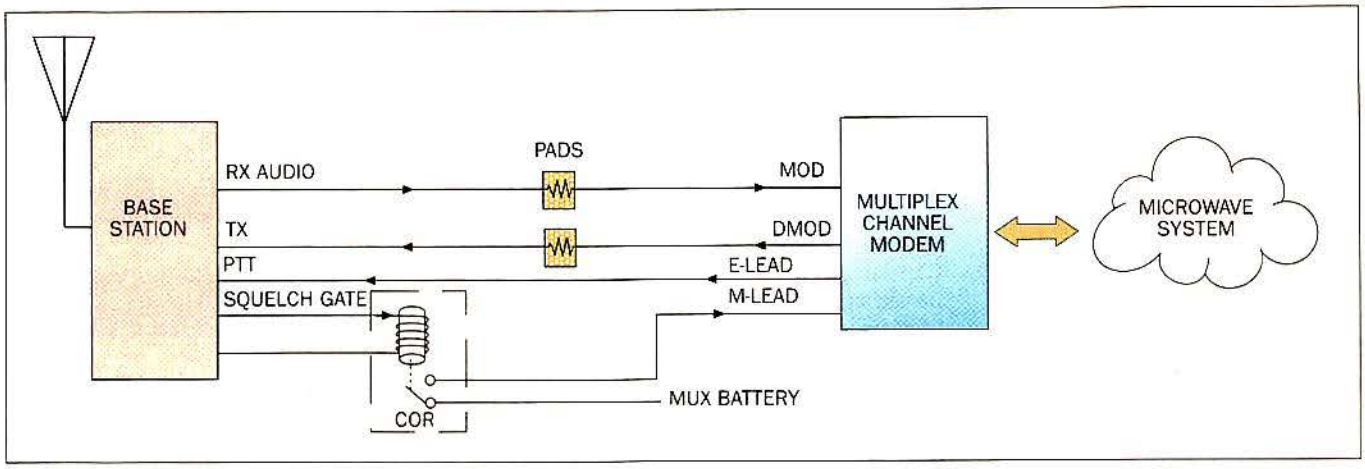

Figure 7. E & M signaling can be used to relate receiver squelch gate status to the control point.

routed through a pad to the base station exciter. Because the transmitter has been keyed, the dispatcher's voice will now be broadcast over-the-air. If a radio transmission from a mobile or portable field unit is received by the hilltop base station, it is routed through the receiver to a pad, then on to the mux MOD connections. The recovered signal is delivered from the DMOD of the office-end mux, through a pad to the console speaker amp. The dispatcher now hears what is being received by the hilltop radio.

Some base stations may require a specific keying voltage that originates within the radio itself. Figure 4 on page 28 illustrates such a situation. On receipt of signaling from the dispatcher, the voltage obtained from the base station is routed into the mux channel F-lead, then back out the E-lead to the radio PTT line.

Tone-remote base stations are common. Figure 5 on page 30 shows the hilltop end of such a circuit. Signaling functions such as keying, channel switching and disabling the receiver CTCSS decode function are accomplished through the use of different tone frequencies. The tones are contained within the normal passband of the circuit and therefore do not require use of E- or M-leads.

Figure 6 on page 32 is an example of a remote-controlled data radio. As in the previous example, E & M-Leads are not necessary because the supervisory information is embedded within the data being transported. The hilltop mux modem receives data originating from the host computer on the office-end.

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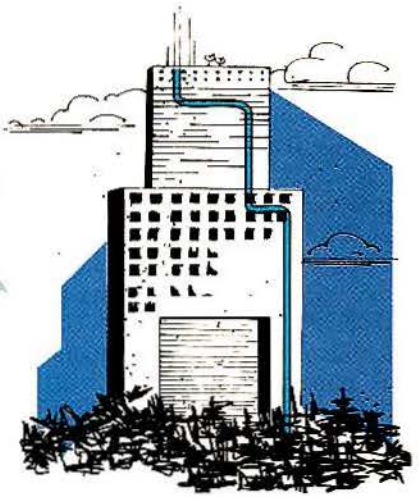

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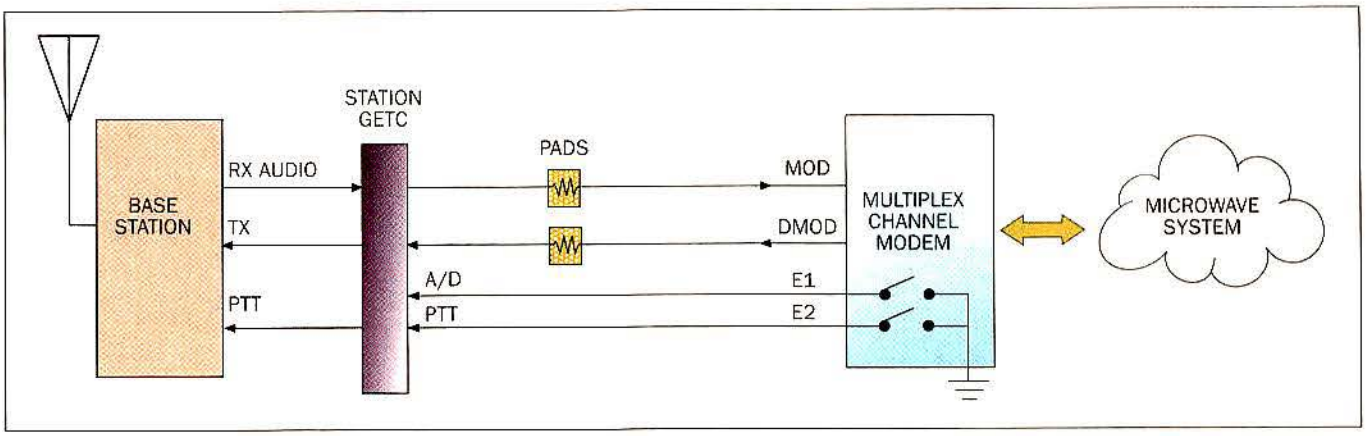

Figure 8. An EDACS simulcast system uses multiple signaling leads.

The VF DMOD signal is padded, then applied to the receive side of a 4W data modem. The modem converts the analog VF receive data signal to a digital (usually RS-232) format. The digital data is then cabled to the base station controller (BSC). The BSC develops a PTT function from the receive data signal and deviates the transmitter with an analog data modulation scheme. The transmitted data is received by mobile data units in the field. In the uplink direction, recovered data from mobiles and portables in the field is sent back to the BSC, modem, pad and mux MOD. The multiplexed data transmission is transported back to the office host computer via microwave.

The most common scheme for transmitting the hilltop receiver squelch gate status back to the office is through the use of a status tone. Since typical status tone frequencies of 2,175Hz and 1,950Hz fall within the bandpass of a mux circuit, the use of E- and M-leads is unnecessary. It is possible however, to accomplish the same thing with E- and M-leads, as shown in Figure 7 on page 34. The active squelch gate voltage level must be compatible with the mux channel M-lead operating voltage range. This is often *not* the case and a Carrier Operated Relay (COR) must be added between the base station and the M-lead to convert the voltage levels appropriately. The COR is activated when the base station receiver unsquelches. Battery from the mux is routed through the COR contacts and applied to the M-lead. Activation of the hilltop M-lead in turn operates the office-end E-lead. The office-end E-lead connection can be run to an E and M style voter or used simply to light a lamp on the dispatcher console indicating receiver

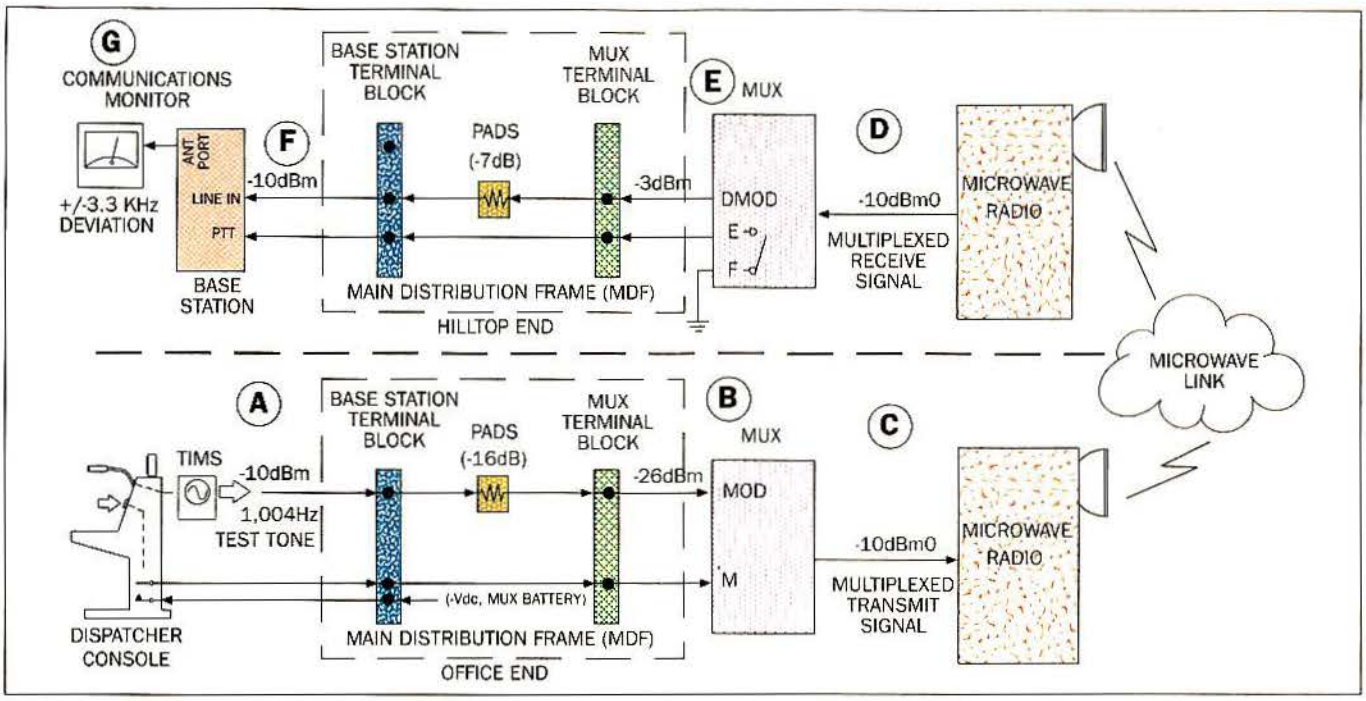

Figure 9. Setting transmitter levels through the system.

activity for that hilltop.

Figure 8 on page 36 is a simplified illustration of the VF and signaling connections for a simulcast EDACS trunking system.This application uses a mux modem with two E-leads. One E-lead is used to key the transmitter (PTT), while the other switches the station GETC between analog and digital modes (A/D).

Circuit level alignment

Circuit level alignment should be performed not only after the circuit is first installed, but also periodically to ensure proper performance. The most common piece of test equipment used in the VF alignment process is a transmission impairment measuring set

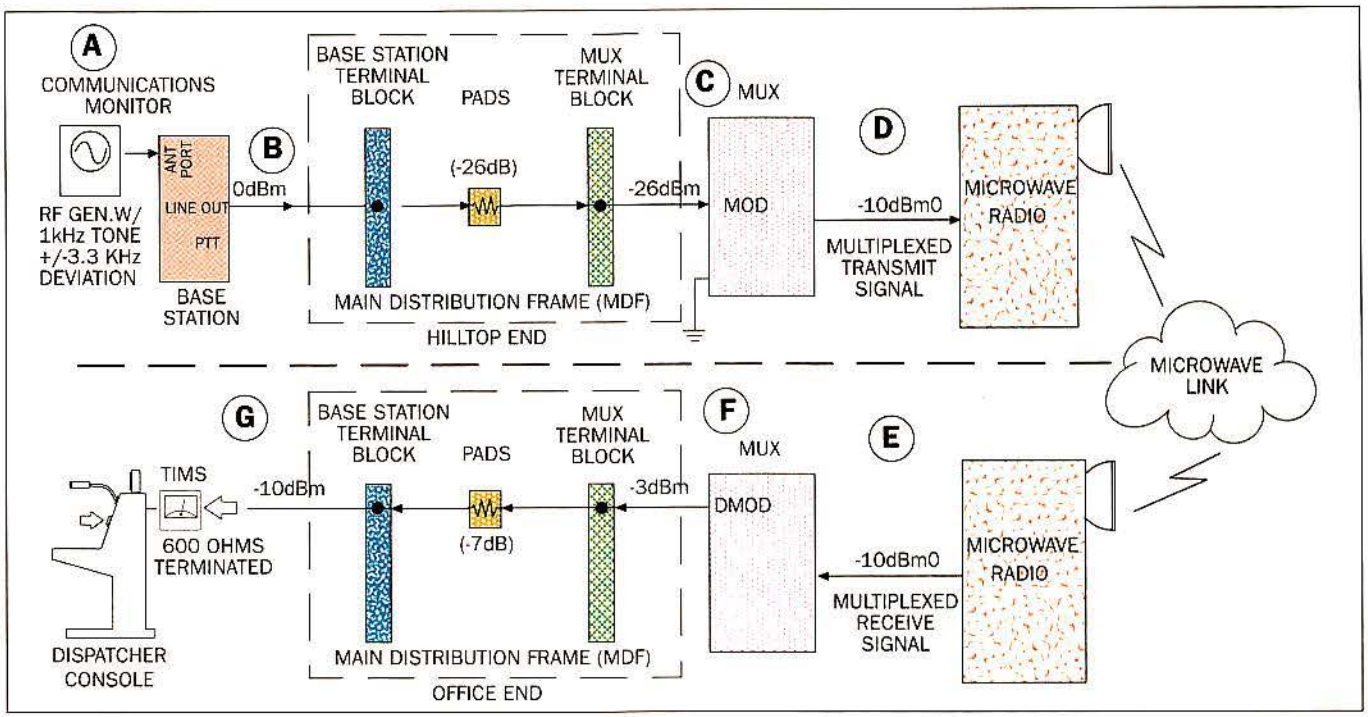

Figure 10. Setting receiver levels through the system.

(TIMS). This device transmits VF tones over a wide range of frequencies and levels. In its receive mode, it offers critical measurement of tone levels and frequencies in several impedances, bridging or terminating. The more sophisticated TIMS can run circuit parameter tests such as impulse noise, signal-to-noise ratio, noise-to-ground, PAR, distortion and others.

Figure 9 on page 37 and Figure 10 above illustrate a 4W, E and M mux circuit between a dispatch office and a hilltop. The letters A through G indicate test points at which level measurements can be made. Actual circuit levels may vary, depending upon the application, however these figures serve as a general example of how and where to make level measurements from one end of the circuit to the other.

Figures 9 and 10 assume that the dispatch console is set up to send and receive a maximum level of 0dBm, with average voice levels being 10dB lower(−10dBm0). Using a constant-level test tone makes the alignment process much easier than with signals such as voice that vary significantly with time. For this reason, the circuit is broken at the output of the console and a TIMS is inserted to inject a −10dBm (−10dBm0) tone at point A.

The typical frequency sent by a TIMS for circuit testing and alignment is 1,004Hz. This tone is sent to the mux channel MOD, via a −16dB pad. The pad adjusts the level to hit the MOD at −26dBm. Because test tone level at the MOD is −16dBm, the −26dBm tone level is still−10dBm0 (10dB below test tone level). This −10dBm0 level is maintained throughout the length of the circuit. The tone level at point B should be verified with a TIMS. If the TIMS is clipped across the balanced pair (paralleled) it should be set to the *bridging* mode. It is placed in the *terminating* mode if the circuit is broken and con-

nected directly into the TIMS.

When the dispatch console transmit button is pressed, battery voltage is applied to the mux channel M-lead to activate signaling. A dc voltmeter can be used to verify presence of the signaling voltage at the M-lead connection (Point B).

The tone is then multiplexed through digital or analog methods. Because the signal at point C is multiplexed, a TIMS will be of no value to verify VF tone levels. If FDM (analog) equipment is used, and the channel baseband frequency slot is known, a frequency selective level meter (SLM) can make the level measurement. On the other hand, if TDM (digital) equipment is used, a T1 tester with DS0 drop and monitor capabilities can be used. Presence or absence of circuit signaling may be verified with these same test instruments. VF level discrepancies should be eliminated by adjusting the mux channel MOD level adjustment.

The multiplexed signal is injected into the microwave radio and transmitted to the hilltop. Once received at the hilltop, the multiplexed circuit VF tone level (point D) may again be verified using the same means as at point C. If the tone has not maintained the −10dBm0 level, the discrepancy is being introduced by the microwave radio equipment and should be corrected. This is a likely scenario with analog microwave equipment. The transmit deviation may be incorrect on one end, or the receiver demodulator output level may be wrong on the other. Adjustments can be accomplished within the microwave radios to correct these problems. This type of level discrepancy should not occur when using a digital microwave equipment, however. Here, VF levels within multiplexed circuits are a function of the multiplex equipment *only*.

At the hilltop mux DMOD (point E), a level of –3dBm should be realized to maintain the –10dBm0 circuit levels. A –7dB pad reduces the tone level to provide compatibility with the particular base station line input level requirements (in this case −10dBm). The base station antenna port should be terminated into a communications monitor to check the transmitter deviation level without broadcasting the test tone over-the-air. Transmitter keying is accomplished when the office-end M-lead is detected by the hilltop E-lead circuitry. Activation of the hilltop E-lead applies a ground to the PTT line, keying the base station.

The communications monitor is set to the base station transmit frequency. The modulated tone level should result in ²/₃ of the maximum allowable deviation when the transmitter is keyed. Discrepancies in transmit deviation levels are eliminated by adjustment of a line input level or exciter level adjustment within the base station itself.

Figures 9 and 10 illustrate transmitter deviation of ±3.3kHz, which assumes the maximum transmitter deviation is ±5kHz. The maximum transmitter deviation adjustment should be set prior to the circuit alignment process.

This completes the alignment process in one direction only. Figure 10 shows how alignment would be accomplished in the opposite direction. The communications monitor is set to the base station receive frequency and put into the signal generate mode. Modulated with a 1kHz tone to ²/₃ maximum deviation (±3.3kHz), sufficient RF signal (typically 1,000μV) is injected into the receiver to produce a clean sounding tone with no audible noise.

A TIMS (in the bridging mode) can be clipped across the balanced pair at point B to verify the tone level out of the receiver. The line output level adjustment of the base station should be set for 0dBm. The tone is then sent through a pad to adjust the level for −10dBm0 at the MOD (an absolute level of −26dBm), which can be verified by a TIMS at point C. Once multiplexed, the tone may be monitored at point D by a SLM or T1 tester with DS0 drop and monitor capabilities, depending on whether analog or digital mux is used. The multiplexed signal is injected into the microwave transmitter and transported to the office-end.

After being demodulated through the microwave receiver on the office-end, the multiplexed signal at point E can once again be checked for proper levels, as at point D. The output of the mux channel DMOD can be adjusted to produce a −10dBm0 signal (−3dBm) while monitoring with a TIMS at point F. Finally, the tone is padded appropriately to hit the terminated TIMS at the level required for proper console operation (−10dBm).

Summary

Emergence of new wireless applications has resulted in increased demand for both base station and circuit transport equipment. A complete understanding of how these and existing remote systems operate not only requires knowledge of two-way radio but transmission systems as well. Familiarity with circuit VF and signaling schemes is basic to the successful implementation of any remote radio system controlled over microwave. ■

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iTech Intelligent Technologies

iTech

iTech offers battery testing with the IQten programmable battery test system offering 100mA–2A of power on all five stations. 800-233-6868, ext. 2102, www.itecheng.com

Circle (315) on Fast Fact Card

MODUCOM

Modular Communications Systems

Modular Communications Systems designs radio dispatch console systems. The Ultracom NT dispatch console is a digital, 32-bit system with programmable touch screens, system customizer and diagnostics included.

Circle (316) on Fast Fact Card

MOTOROLA

Motorola

The Motorola R2600 series of communication systems analyzers tests analog and digital two-way radio systems. The platform provides support for IDEN, MPT1327/1343, Motorola analog trunking. www.AccessSecure.-mot.com/Accesspoint

Circle (317) on Fast Fact Card

RITRON®

Ritron

Ritron manufactures a complete line of land mobile radio products including portables mobiles, repeaters, data telemetry modules and accessories for worldwide distribution.

Circle (318) on Fast Fact Card

SCA

SCA is leading the market in tone/voice paging. Along with tone/voice, it has extended its line to include POCSAG digital paging.

Circle (319) on Fast Fact Card

SHURE

Shure

Shure's 810 speaker micro-

phone, part of the Modulink system of interchangeable microphones and cords, provides sound performance and reliability even in foul weather.
Circle (320) on Fast Fact Card

Telepath

Telepath is a provider of two-way radio and wireless communications products specializing in two-way business communications. www.tele-pathcorp.com
Circle (321) on Fast Fact Card

Thunder Eagle

Thunder Eagle is a designer, manufacturer and distributor of weather alert radios for emergency management and other professional users. www.thuneagle.com
Circle (322) on Fast Fact Card

TIMES MICROWAVE SYSTEMS

Times Microwave Systems

Times Microwave Systems specializes in the design and manufacturing of high-performance, flexible and semi-rigid coaxial cable, connectors and assemblies for RF transmission from HF through microwave frequencies.
Circle (323) on Fast Fact Card

TPL Communications

TPL Communications is a manufacturer of RF power amplifiers, VHF low band through UHF high band for mobile, base station/repeater applications.
Circle (324) on Fast Fact Card

TX RX SYSTEMS INC.

TX RX

TX RX provides multicouplers, combiners, signal boosters, antennas, tower-mounted preamplifiers, duplexers, filters and other RF system products for use in the 100MHz to 1GHz range.
Circle (325) on Fast Fact Card

Vega

Vega manufactures specialized radio/telephone dispatched control consoles and associated base station adapter panels, as well as audio processors, audio amplifiers and tone encoder or decoder. www.vega-signaling.com
Circle (326) on Fast Fact Card

STANDARD HORIZON

Vertex Standard

With experience in land mobile radio, Vertex Standard offers a wide variety of public safety equipment from cross-band repeaters to public safety portables and mobiles.
Circle (327) on Fast Fact Card

W&W MANUFACTURING CO.

W&W Manufacturing

W&W Manufacturing manufactures two-way radio replacement batteries, chargers and analyzer/conditioners. More than 200 charger and analyzer adapter cups are available for land mobile radios, cellular phones and laptops.
Circle (328) on Fast Fact Card

ZETRON

Zetron

Zetron designs, manufactures and markets more than 100 wireless communications systems, including radio and telephone consoles, paging systems, trunked radio, SCADA and telemetry, utility networks and land mobile radio.
Circle (329) on Fast Fact Card

Circle (41) on Fast Fact Card

Circle (42) on Fast Fact Card

Watch out for Y2K

We're not going to tell you again: Jan. 1, 2000, is looming around the corner. Agencies and companies not actively fixing their systems should be making contingency plans. The FCC finds medium-sized public safety entities and service providers are most at risk.

By Nikki Chandler

January 1, 2000, is inexorably approaching. While the public is wondering if it will have electricity or enough drinking water (or which party to go to), the FCC is wondering if the wireless telecommunications industry will be ready for Y2K. With only five months to go, agencies and companies that have not reached compliance yet (and especially those that don't even *have* a plan yet) should be preparing contingency plans. Even an agency close to 100% Y2K compliance should not overlook contingencies. The magnitude of the problem (more than 25 billion equipment-embedded chips in the United States alone) makes some system breakdowns likely.

"Emergency services are crucial to the life and safety of Americans, and the Year 2000 problem poses a real and palpable threat to the continued operation of these services," said FCC Commissioner Michael K. Powell on April 29 before the Senate Special Committee on the Year 2000 Technology Problem.

The FCC has decided that the wireless communications sector, commercial and emergency, is at risk, "given the uncertainty of its efforts at this time."

Y2K communications sector report

The FCC's efforts to identify risks posed to communications systems is documented in the *Y2K Communications Sector Report*, issued in conjunction with the Network Reliability and Interoperability Council (NRIC) on March 30. NRIC is a broad-based federal advisory group that was chartered to advise the commission on network reliability issues, including Y2K.

The FCC conducted a survey that targeted a random sample of 300 commercial wireless entities, including licensees in the cellular service, personal communications services, SMRs and paging services. Thirty-one percent of all carriers responded to the survey. In 1997, however, there were about 108 million commercial wireless subscribers, so the responses received represented less than 40% of the entire wireless customer base.

The FCC said that it was encouraged by the progress being made by larger companies to prepare and was "cautiously optimistic" about the ability of the companies to withstand unforeseen problems with minimal disruptions to services.

The FCC expressed concern about the smaller companies, however. Many of the small- and medium-sized companies that have adopted a systematic approach to addressing Y2K have completion deadlines dangerously close to the dreaded date, which leaves scant time for delays from vendors or remediation of problems discovered during systems testing. Many small companies have not even adopted systematic approaches to addressing Y2K.

The report did not assess Y2K readiness in the private wireless community, which represents more than 16 million users, except in its discusssion of emergency services (about 10% of private wireless). Because of concerns about the Y2K readiness of all wireless entities, the FCC is undertaking another survey to assess the status of non-commercial wireless licensees. Despite the FCC's lack of private wireless documentation, sources within that sector express confidence in general preparedness.

"Because private wireless systems promote productivity, few companies are anxious to provide detailed information on their Y2K compliance, which might be used against them by their competitors," said J. Sharpe Smith, communications and public affairs manager for the Industrial Telecommunications Association (ITA). "We have been assured by the major radio system manufacturers that the lion's share of the land mobile communications equipment out there will not be affected when the calendar flips over to Jan. 1, 2000, or one of the other crucial dates."

"It is my sense that the major corporations in the United States have moved forward on this issue and are correcting any problems in their computer systems, including their private wireless systems," Smith said. "For example, Federal Express is already using its second generation of Y2K-compliant equipment in its mobile data terminals. Now *that's* proactive.

"It looks like users of older analog dispatch systems will be unaffected. This means that smaller companies, which don't have the staff to reprogram their radio systems, won't lose communications due to this computer bug. It is, perhaps, the mid-size companies with more complex networks that need to be the most careful," Smith said.

Commercial services

The FCC's survey of wireless carriers revealed a preparedness gap between the large and small wireless companies. Only about half of the operators serving less than a half-million customers have implemented a remedial plan or process, while large operators have completed almost 60% of their fixes.

The survey did reveal that 54% of *total respondents* (representing about 23 million pops) have implemented a Y2K remediation plan or process. All of the responding carriers should have a remediation plan complete before December 1999. Because of the low response rate and the late completion date forecasted, however, the FCC said that

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TX communications center plans for year 2000

Computerized public safety agencies are grappling with how best to prepare for the Year 2000. Even for innovative agencies, like the one in Richardson, TX, that adopted computer-assisted dispatching systems (CAD) in the late 1970s and have continued to update and improve their technology, the Y2K bug presents serious challenges that must be met over the next few months.

Richardson began a Y2K analysis of all electronic equipment, from computer hardware and software to photocopiers more than a year ago.

The city first formed a Y2K analysis team comprising staff members and consultants to identify the problem areas in each department, followed by a committee to present viable solutions and to develop contingency plans based on "what if" scenarios.

For Capt. Joe Hanna, manager of the Public Safety Communications Center for the city of Richardson, the analysis confirmed that the 250-employee department's communications system was *not,* as suspected, Y2K compliant. During the past several months, the department has identified several alternatives for solving the problem. These range from having the vendor upgrade the current CAD system to replacing it with a completely new, Windows NT-based system from another vendor to "applying a Band-Aid" to the existing system, which will provide a quick fix and buy them more time.

With countless man-hours and hundreds of thousands of dollars invested in hardware and software, replacing an entire CAD system is no snap decision.

In the case of the Richardson center, people have labored long and hard to establish and continually improve the software systems used to run the public safety operations: CAD, mobile computing terminals, jail booking management, records management, warrants, citations and other modules.

As communications managers like Hanna, who is also president-elect for the Association of Public-Safety Communications Officials—International (APCO), ponder system overhauls for Y2K, they must consider issues such as data conversion: the data that pop up next year must be consistent with what's being used now. Staff must be trained, downtime must be managed.

The vendor Richardson bought its CAD system from in 1992 has itself been sold to a new owner, as have many legacy CAD vendors. Still, the Richardson department is assessing whether the new owner can help take the department's system where it needs to be, through the Y2K issues and in the longer term.

Like many CAD systems written in older computer languages, Richardson's will not operate in 2000 as is. Its vendor says the existing system can be upgraded into compliance. The system works well, Hanna said, and the department is satisfied with it. Because of the substantial money and time invested in the current system, Richardson opted for a "Band-Aid" interim solution that will allow its CAD system to continue running into 2000 and give the city time to evaluate its long-term options.

"We're in line, waiting for our fix," Hanna said. "You weigh when you might move to the line that appears to be moving faster. But we don't know that we have another real choice but to apply the fixes we have. So we're taking the Band-Aid approach."

Richardson does have a choice about the extent of its fixes and what quantity of resources to devote to them. After clearing the Y2K hurdle, the city could then decide to acquire an entirely new CAD system, Hanna said.

It might. For the Richardson center, the Y2K issue has catalyzed a review of the entire system and an investigation into what additional capabilities the department will need in the future to keep pace with the growing city.

For now, the baseline demand is to ensure that Y2K issues do not compromise basic CAD capabilities. If the system shuts down entirely, it would leave Richardson's police, fire and EMS operations operating manually; not impossible, but certainly a major setback.

Richardson, a city of 85,000 residents and a major business center for telecommunications companies, began studying its Y2K factors in late 1997. The city is still slightly behind where it would like to be, though, Hanna said. Right now, he added, if he and his staff were to decide a major change is needed, it might be impossible to act because many CAD vendors are booked up and the governmental procurement process is protracted.

—Simon Aleman
Global Dispatch
Oklahoma City

greater effort should be devoted to contingency or backup plans.

The *backup* backup plan

About 42% of the FCC's survey total respondents have begun contingency planning: 64% of large carriers and 40% of small carriers. The large carriers average less than 50% completion, however; and small carriers average 70% completion of probability of risk assessment for all items.

The impact of Y2K problems is hard to measure at this point, but the potential for disaster looms. Cellular, PCS and paging providers could lose revenue, customers and reputation for reliability. These risks incite some kind of preparatory action, with large carriers doing just that. However, as the survey showed, only about half of the other operators serving less than a half-million customer have implemented such a plan.

Emergency services

The FCC noted the importance of dispatch centers or Public Safety Answering Points (PSAPs) to emergency service call processing. Local communities own these systems and must take the necessary steps to prepare these systems for Y2K.

Costis Toregas, president of Public Technology, Washington, wrote in *American City & County* magazine in May 1999, that in fact, *multiple areas* of local government, from water serv-ices to public safety functions and emergency systems, needed to be Y2K complaint. "Y2K also affects functions as diverse as the operation of doors in jails and sophisticated medical devices in county hospitals," Toregas wrote.

The FCC stated that the challenge to emergency communications was that several systems must interoperate seamlessly to ensure timely response by emergency personnel.

"Virtually every link in the emergency chain involves complex interrelated processes, and everywhere there are time-date stamps," said Robert Miller, technical issues director of the National Emergency Number Association (NENA), at the "Year 2000: Maintaining Emergency Response Communications" forum.

A concern lies with the call processing at the PSAP. Such telecommunications equipment is not under the direct jurisdiction of the FCC nor within its area of expertise. The assessment of the readiness of the PSAPs is difficult because of the disaggregated nature of the control and ownership of this equipment, Powell said. NRIC estimates that there are 6,739 PSAPs in the territory of the eight largest telephone companies and that they have service contracts with 81% of those, or 5,456 PSAPs. Of those, 35% have been remediated for E9-1-1 call processing. These numbers do not account for small PSAPs, which the FCC doesn't know about.

Dispatch remediation

The third element in emergency communication involves dispatching emergency response teams. Manufacturers report that analog and digital radio systems operating in unencrypted, conventional mode (non-trunked mode not involving computer switching) are not date-sensitive and therefore are not typically at direct risk for Y2K failure.

For radio systems using computerized trunking, encryption, gateway and other advanced computerized features that are at higher risk for Y2K failure, manufacturers report that they are engaged in active user notification and remediation assistance programs. The major manufacturers controlling 90% to 95% of the public safety equipment market have reported that all new equipment now being sold is Y2K ready, and upgrades or remediation packages for all legacy equipment are now or will shortly be available.

Computer-assisted dispatch (CAD) may be at greater risk for Y2K failure. Replacing CAD systems may also take more than one year, so non-compliant CAD systems might not able to be replaced by 2000 (see sidebar on page 43).

Accountability for failure

The risks stretch beyond equipment failure, however. Companies and governments could face lawsuits. The volume of legal claims from Y2K is projected to total as much as $1 trillion. Citizens could claim damages for personal injury resulting when a city's E9-1-1 emergency dispatch system is slow or non-operational, delaying the arrival of an ambulance or police.

It is too late to *start* planning for Y2K. If a company, carrier or agency does not have a remediation plan in place, contingency planning is a must. ■

Backup power service

By Harold Kinley, C.E.T.

The backbone of the South Carolina Forestry Commission's radio communications system is a VHF high-band repeater network with associated control stations at strategic points. Some of the repeaters are located at sites that have backup generators on standby. If the power fails, the generator will start and, once stabilized, will supply power for continued operation during the power outage. The other sites have no available backup generator. A question arose as to how we could obtain an alternative (meaning less expensive) source of backup power for these other sites.

Our repeaters, base stations and control stations operate from a 12V power supply. In our particular forestry region, our repeaters, control stations and base stations are scattered over a 19-county region. We also have personnel with pickup trucks, transport trucks and crawler tractors spread out over the same geographical region.At least one employee is stationed near to almost every base station, repeater or control station. So, the idea of using a vehicle's 12V battery to supply temporary backup power in an emergency was a cheap alternative to installing permanent power generators at these remote locations.

Sure, there would be some downtime associated with a power outage, but the tradeoff of some downtime against the cost of permanent backup generators was considered acceptable. All we needed to do was come up with an arrangement that would allow employees to temporarily hook up the vehicle battery through jumper cables to supply battery power to the repeaters or base stations, as needed. The idea was to make it simple and goof-proof (or should I say, goof-resistant) so that any chance of a calamity was minimized.

All we needed to do was come up with an arrangement that would allow employees to temporarily hook up the vehicle battery through jumper cables to supply battery power to the repeaters or base stations.

The base stations and control stations that we use would be no problem because they have a direct 12V external power supply. The repeater has its own internal power supply, but a study of the power supply schematic indicated that it would be possible to integrate the external 12V supply with this internal supply so that no conflict would occur.

Figure 1 below is a diagram of the basic hookup that is used to facilitate using a vehicle battery as the temporary emergency power source. The plus (+) and minus (−) connecting points shown to the right in the diagram are connected to copper pipes that are inserted through the concrete walls of the communication shelters. The pipes are flattened on one end, and a hole is drilled through the flattened end to accommodate a 0.25" stainless steel bolt to which the electrical connections are made. On the outside of the building, a clamp is attached to the copper pipe at the entrance to the building to hold the pipe snugly against the building.

It is important to use heavy-duty relays with contacts sufficient to carry the current load. In Figure 1, two sets of contacts are connected in parallel. For an extra measure of safety, two relays can be used with the same points connected in parallel to handle heavier load currents. Photo 1 on page 45 shows a board with two relays connected in parallel for extra current-handling capability. Notice in Figure 1 that only the positive leg is controlled by the relay. Relays could be used for both legs, but connecting only the positive leg through the relays allows us to lower the voltage drop across the contacts. This also helps prolong relay contact life because each set of contacts is only required to carry a small part of the total load current.

Notice in Figure 1 that relay RLY2 is connected between the positive connecting post and the control relay (RLY1). This relay (RLY2) is a heavy-duty solenoid-type relay that is used in automotive applications such as the "starter solenoid." The positive and negative connecting posts are accessible through the outside of the wall, so that an employee can attach jumper cables from a vehicle to the connecting posts without entering the building. The diode (D1) is inserted in series with the relay coil, so if the jumper cables are

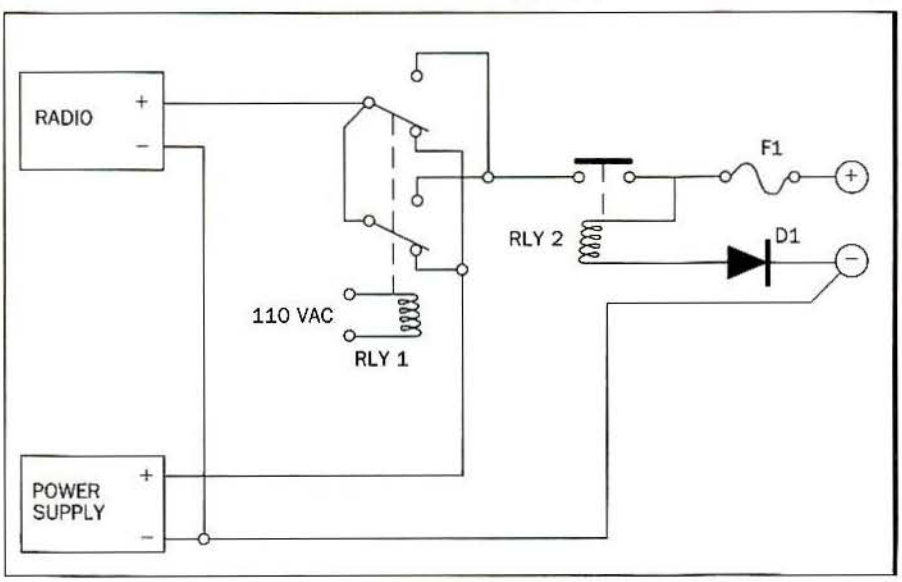


Figure 1: This is the simple schematic of the wiring and control relays used to facilitate connection of emergency power from a vehicle's battery to power the radio during a power outage.

Kinley, a certified electronics technician, is regional communications manager, South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*, which is available for direct purchase. Write to 204 Tanglewylde Drive, Spartanburg, SC 29301. Kinley's email address is *hkinley@home.com*.

connected with reversed polarity, the relay will not be energized and reversed polarity will not be applied to the radio. The relay will energize only when the correct polarity is applied to the connecting posts.

As long as the commercial power is available, the control relay (RLY1) is energized from the 110V ac supply. If a power outage occurs, the control relay is de-energized, and the relay contacts move to the normally closed position. This connects the radio positive lead to the emergency power connecting posts. The radio is dead until personnel arrive and connect a jumper cable from a vehicle to the connecting posts. When commercial power is restored, the control relay is again energized, and power is obtained from the normal power supply.

Heavy-gauge wire should be used for longer runs. The relay wiring can be done with smaller wire for jumpers that are only a few inches long. The voltage at the radio should be checked in both the receive and transmit modes. If the voltage drop in the transmit mode is significant, find out where the voltage drop is occurring. Check across the relay contacts, across the wire between the relay(s) and the radio, and between the relay(s) and the connecting posts on the wall of the shelter.

This backup power "system" is about as simple and inexpensive as it gets. It won't suit the needs of all agencies or operations, but there are many situations where such an application is a viable option and can save a fair amount of money. Employees must be trained to hook up the vehicle jumper cables properly when needed. Alternatively, a battery (deep cycle, marine lead-acid type) can be used along with a "float" charger. The connections to the battery can be made from the "through-wall" posts without the need for the switching relay circuit. The solenoid relay should still be used to prevent improper polarity. An isolation diode should be connected between the positive lead of the float charger and the positive battery post. A number of variations are possible using this same basic principle.

Until next time—*stay tuned!* ■

Photo 1: A fuse is connected between the "through-wall" post and the solenoid relay. Of course, the fuse needs to be adequate to handle the load current.

Photo 2: This 12V solenoid is used to connect the external power souce to the radio for backup power. It is energized when the correct polarity is applied to the "through-wall" posts. The diode prevents incorrect polarity from energizing the solenoid relay.

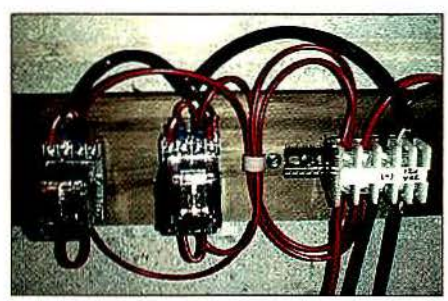
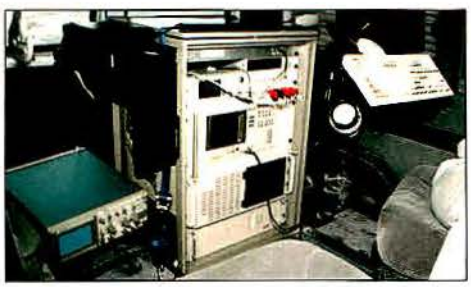


Photo 3: This control relay panel for the MSR2000 repeater is mounted on a board and attached to the wall near the repeater. Two relays are used in the positive leg to prevent too much voltage drop across the relay contacts.

Photo 4: The "through-wall" negative, or ground, post. The end of the copper pipe is flattened and the negative power lead is attached with a 0.25"stainless steel bolt.

ComSpace readies DCMA for 2000

ComSpace, founded by former Uniden America executives David George and Steve Fulford, has spent several years in developing a spectrum-efficient technology with initial applications in business and industrial private two-way radio. The Irving, TX-based company demonstrated its progress toward delivery of microchips, software, mobiles and base stations at IWCE in April.



ComSpace demonstrated DCMA in its booth at the IWCE trade show in April, where it also demonstrated the technology in use in a van during test-drives.

As microchips and software become available, any radio manufacturer will be able to use them to make mobile two-way radio units with "digital channel multicarrier architecture" (DCMA) capability. DCMA places the equivalent of eight voice channels within the space of one 25kHz FM channel at 450MHz and 800MHz, four channels within 12.5kHz at 900MHz and two channels within 5kHz at 220MHz.

"We have received full samples of the application-specific integrated circuit (ASIC) from VLSI," said George, the company's executive vice president. "It's the whole back end of a digital radio, including the analog and digital converters, vocoder, keyboard decoder, LCD driver and IRD port and SIMM card reader, plus the DCMA system. That makes a very nice implementation for a manufacturer. They have only to put this chip in a digital radio, and they have a fully compliant DCMA product. That means brand 'X' can talk to brand 'Y' without standards documents, auditing or testing."

Last summer, ComSpace altered its technology direction, discarding a previous analog air interface in favor of a digital interface.

"With digital, we were able to improve bandwidth efficiency, and we now have eight times capacity improvement," George said.

George described the digital DCMA design as "a lot more work and a good decision" despite its higher complexity compared to analog DCMA. In an analog system, any problem with a synthesizer comes out as an audio signal, which can result in odd squeaks and buzzes, he said.

"In a digital radio, it's just ones and zeros. Noise might come out as a fraction. Mechanisms do error correction and detection. You can have a lot more of those issues than in analog without degrading the sound quality, and as a fringe benefit, a digital radio is good for carrying data," he said.

DCMA supports trunking protocols through its "service option negotiation" or SON.

"SON is like the modem on your PC," George explained. "It takes data, whether Microsoft Word or PowerPoint or JPEG, and converts it into a signal that can pass over telephone wires and reconverts at other end. That's roughly what SON does. If the people who use DCMA want to use Johnson LTR trunking, SON converts the trunking data stream to high-speed digital mixed with voice. At the other end, it filters the LTR out and reconverts it to 300-baud FSK."

Competitors in spectrum efficiency

Voice paths within an equivalent 25kHz FM channel:

Manufacturer	Technology
Motorola IDEN (TDMA)*	6:1
SEA (ACSSB)**	5:1
Intek Global (linear modulation)	6:1
ComSpace (DCMA)	8:1

* Motorola offers a 3:1 option to improve voice quality.

** SEA can double its capacity to 10:1 with ACSSB/DCMA.

Note that these figures apply to voice-channel *capacity* and not necessarily voice *quality*. Data throughput may favor one technology over another despite the voice channel capacity comparisons.

One part of ComSpace's strategy that hasn't changed is its plan to build base stations.

"We've always intended to make the base stations ourselves," George said. "Then we also decided to build our own mobile radio because most of the manufacturers are slow, and we need some kind of a product to develop the marketplace and to prove the technology. We're developing our own radio for that. We will eventually sell the design to someone. We don't intend to be a radio manufacturer. We want to seed the market.

"We want to build base stations, though, because they need to be built robustly. A base station needs to be reliable to support hundreds of customers," he said.

Another motivation is the profit margin on base stations, which is higher than that for mobiles.

"We've already spent $13 million to develop DCMA. We took all the risk and spent the money, and we need to recover the investment," George explained. "The base stations sell for a higher price, so they produce more revenue."

ComSpace's goal is to maintain the dynamics that the FM market enjoyed, meaning a lot of suppliers who are motivated to make innovative products at good prices.

"The FM market is not as healthy as it used to be because users are out of capacity," he said. "With DCMA, we'd like the manufacturers to 'duke it out' for the best units, all with our chips in them. DCMA works at multiple bandwidths, and it isn't frequency-sensitive. We can even double the capacity of a 220MHz channel."

DCMA doubles 220MHz channel capacity with time-domain duplexing. The method allows two voice paths within the same bandwidth, and it allows a single duplex voice path of the type used for telephone-type interconnect. In other words, each party to a conversation can be heard by the other without using a push-to-talk switch common to "half-duplex" mobile radio telephone interconnect. The use of time-domain duplexing avoids the need for a mobile cavity-type duplexer, which at 220MHz would be large.

ComSpace had licensed several manufacturers for its previous analog DCMA, and it has licensed a few for the new digital DCMA. Among the licensees are Datamarine International with its SEA Division, Transcrypt International and its EFJohnson Division, the Kenwood Systems subsidiary of Kenwood Communications, Zetron, Trident Micro Systems, SmartLink Development and Lenbrook. Lenbrook is one of ComSpace's initial investors.

Additional information is available on two Web sites: www.comspacecorp.com and www.dcmaradios.com. *DB*

ComSpace Timetable

Microchips	**5 weeks ARO**
Software	**October**
Mobiles	**1Q 2000**
Base stations	**1Q 2000**

ACT changes name to Enrev, licenses software

Advanced Charger Technology (ACT), Atlanta, has changed its corporate name to Enrev Corporation. The company will use the name ACT, but only for the unit that will continue its business in battery chargers. The company's main growth engine will be the licensing of the battery operating system. The company, still privately held, has been raising money from venture capitalists and has raised $5.5 million. Enrev employs 65 people.

The software, Enrev OS, allows batteries to charge five times faster, deliver consistent, dependable power between charge and sustain four times longer than currently available technologies.

"Research has shown that battery limitations are a significant hindrance to mobile device performance and long-term reliability," said Karen Robinson, president of Enrev. "If battery performance can be substantially improved, so can the usefulness and productivity of the devices they power. That's what Enrev Corporation is all about."

Throughout the charging process, the Enrev operating system adapts responsively to the battery's electrochemical state via a unique algorithm that provides real-time feedback, maintaining the battery at the optimum charge level. Scalable and effective with all major battery chemistries in use today, Enrev technology can be designed into the electronics of devices such as cellphones, personal digital assistants and laptop computers as well as forklifts and electric vehicles. The system blends the disciplines of electrochemistry and electrical engineering to form a stimulus response model that interactively and dynamically charges the battery. Enrev technology works with all major battery chemistries including Li-ion, NiMH, NiCd, lead acid and Li-polymer. *MRT*

FCC Notes

LMDS auction raises $45 million

In May, the FCC completed a Local Multipoint Distribution Services (LMDS) auction that raised a total net revenue of $45,064,450. The auctioned licenses can be used by companies to provide a variety of wireless services for consumers including: one- and two-way broadband services, such as video programming distribution; video teleconferencing; wireless local loop telephony and high-speed Internet access.

The auction began on April 27, 1999, and closed after 43 rounds. A total of 161 licenses, 100% of the licenses available in the auction, were sold to 40 bidders. The licenses will be awarded in various geographic areas throughout the continental United States and Puerto Rico.

FCC dismisses petition against Nextel License Holdings 4

On June 22, 1998, Dennis Brown and Robert Schwaninger Jr. filed a Petition to Dismiss or Deny against Nextel License Holdings 4 on behalf of clients who operate 800MHz SMR systems in the Maricopa County, AZ, area. In the petition, dismissed by the FCC on April 30, 1999, Brown contended that certain 800MHz SMR applications filed by Nextel were defective and did not comply with the FCC's rules. He also alleged that the applications contained misrepresentations of material facts that require the FCC to ascertain whether Nextel had the character qualifications to be an FCC licensee. He contended that the applications did not comply with Section 90.693 because Nextel had no incumbent stations whose 22dBu field strength contour could encompass Nextel's proposed sites. The FCC requested that Nextel provide additional information regarding the application, and Nextel acknowledged that it had incorrectly calculated its existing composite 22dBu contour with respect to certain sites specified on the applications. Based on this, Nextel surrendered the licenses for all 800MHz stations that were previously granted in Maricopa County and also withdrew its one remaining pending application in Maricopa County. The FCC also rejected the claim of whether Nextel had made intentional misrepresentations.

Batteries

Batteries support wearable power source

Battery Engineering's rechargeable lithium battery systems are for wearable power sources. The lithium power systems offer the high power needed for advanced industrial and military applications, but are less than half the weight of the NiMH systems. The power sources come in standard and customized sizes. The standard offering for wearable systems is a flat, lithium-ion polymer cell measuring 4" × 6". It will fit into vest pockets and will allow various voltage taps to be picked as needed. The system offers 14Ah of rechargeable capacity at 12V. In custom configurations, battery size and voltage can be designed to customer specifications. The cells can be recharged as much as 500 times and discharged as high as the 2C rate. A single charge lasts about eight hours, making it suitable to last a complete shift in an industrial application.

Circle (351) on Fast Fact Card

Battery provides reliable backup

Hawker Energy Products has expanded the Hawker XT series of valve-regulated, lead-acid batteries to include a new footprint, the Hawker XT 35. The batteries provide reliable backup in distributed power and wireless telecommunications where abusive environments are increasingly commonplace. The battery is a replacement for distributed power cabinets, and it offers 35Ah in a 25Ah shelf. The battery is a suitable replacement for remote telecommunications cabinets and SLC replacements. The battery is designed in an industry-standard JIS footprint, constructed in red, 94V-0 flame-retardant plastic.

Circle (352) on Fast Fact Card

Batteries work for Ericsson radios

The R1202 (1,200mAh) and R1203 (1,700-mAh) replacement batteries from **Alexander Technologies** are for Ericsson Prism radios. The batteries have an ultrasonically sealed high-impact housing. The batteries are constructed new to meet or exceed OEM specifications. The company does not retrofit (rebuild) used batteries. The shelf life is five years when stored at 77°F. Each cell is safety-vented.

Circle (353) on Fast Fact Card

Primary batteries feature high voltage

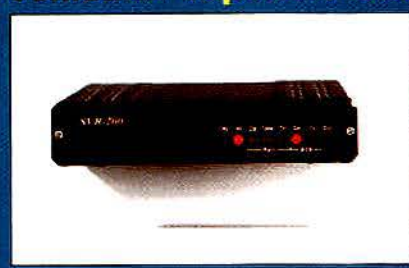
Tadiran's Pulses Plus 3.6V cylindrical primary batteries are lithium thionyl chloride cells that deliver the higher voltage, higher capacity and lower self-discharge required by high-current pulse applications. The batteries have a hermetically sealed hybrid layer capacitor (HLC) and bobbin-type construction. Features include a capacity of 19Ah for the D size cell, and a self discharge of less than 2% per year.

Circle (354) on Fast Fact Card

READERS' CHOICE

Of the new products in the November 1998 issue, this one generated the biggest reader response. For more information on this product, circle the corresponding Fast Fact Card number on the card found in the back of this issue, and mail the card to us.

Vehicular repeater extends hand-held range



The SVR-200MA vehicular repeater from **Pyramid Communications** is available for UHF, VHF and 800MHz transmitters. The repeater extends the range of the hand-held radios by interfacing between a high-power mobile radio and a low-power hand-held, and is Motorola PAC/RT, LTR, EDACS and Motorola trunking compatible. The repeater features completely automatic operation and the ability to create a priority multi-unit hierarchy for as many as 256 vehicles. In addition, the unit offers "first man out" with priority sampling. This compact unit (5.275" × 6" × 1.12") offers benefits to public safety, paramedics, utilities and fleets by providing wide-area coverage without expensive satellite receivers, maintaining communications even inside buildings and eliminating the need for pagers and cell phones.

Circle (500) on Fast Fact Card

Antennas provide wideband coverage

The **Maxrad** Low-profile Vertical (MLPV) antenna series consists of two models capable of covering frequencies from 806MHz to 960MHz and 1,700MHz to 2,500MHz with superior pattern coverage. The attractive, compact design makes the antennas suitable for mobile or base station applications requiring minimum visibility. A ¾" hole mount mechanism helps installation into an existing mount and/or replacement of existing antennas. They provide superior performance to a quarterwave over a ground plane.

Circle (401) on Fast Fact Card

Mobiles operate in trunking or conventional

The TK-780/880 VHF and UHF mobiles from **Kenwood Communications** are part of the 80 series family of radios that are designed to operate on multiple systems: conventional, trunking, wide or narrow bandwidth. The radios feature Fleetsync, which provides built-in alphanumeric two-way paging. The mobiles operate in either LTR trunking format or conventional format. In LTR trunking mode, the radio has a capacity of 32 systems with multiple talk groups. In conventional mode, the radio is capable of 250 channels. The Fleetsync feature means pre-stored status messages and customer alphanumeric text messages can be sent and received. Messages can be stored in memory for later review and each unit's pre-assigned ESM is tagged to messages for origin identification. The mobiles have a data connection port for modems or external mobile data terminals, an option available with the addition of the Kenwood KCT-19 or KGP-1A and KCT-20 options (for AVL capabilities). The units are built to meet or exceed U.S. military standards 810 C, D and E. The die-cast chassis and compact design make the mobiles easy to install in any vehicle.

Circle (402) on Fast fact Card

Trunking antenna performs at 3dBd gain

The ASP-7920 800MHz rooftop trunking antenna from **Antenna Specialists** is suitable for trucks and cargo vans. The antenna produces a full 3dB (5dBi) omnidirectional gain from its 5/8 wavelength upper and 1/4 wavelength lower section whip, and covers the 806MHz–869MHz frequency range without tuning. With one-piece stainless steel whip construction including phasing coil, this antenna has a VSWR of better than 2:1, a 100W maximum power rating and ships with a ¾" universal Motorola NMO-style mount for convenient installation. Available in three model configurations, the ASP-7920 includes a 17' Pro-flex cable. The ASP-7921 has a 14' RF-58/U.

Circle (403) on Fast Fact Card

Connectors work with plenum cables

Times Microwave Systems' Ez connectors are for the plenum-rated LMR-400-LLPL and LMR-600-LLPL cables. These connectors can be installed on the cable with no soldering of the center pins and with a crimp connection to the outer conductor. Cable prep tools are available to trim the cable to the proper dimensions for connector attachment. The entire process of cable trimming and connector attachment can be accomplished in minutes, resulting in savings in installation costs. Connectors with solder-on center pins are also available. The cables combine low loss and flexibility with a plenum rating. This allows for their installation inside buildings anywhere, including air-handling spaces. Their flexibility allows easy routing in tight spaces making them suitable as antenna feeders for many applications.

Circle (404) on Fast Fact Card

Spread-spectrum modem links various devices

The **Aerotron-Repco Systems** Bluestreak is a high-speed digital communications modem capable of linking various electronic devices. Because wireless RF spread-spectrum technology, no FCC license is needed. Plug in the unit and immediately establish a data link. The unit can be configured in point-to-point, point-to-multipoint and broadcast group operation. In broadcast mode, all units within the group receive messages from one unit within the group. Repeaters can be configured for broadcast groups as well. With the fast setup feature, just press a button on the modem to initiate handshake operation with other modems. Data transfer between modems including compatible communication parameters and address information. After fast setup, the modems can be placed in service and do not require any additional setup operation.

Circle (405) on Fast Fact Card

Brochure covers welded shielding system

Lindgren RF Enclosures' welded shielding system details the room concept that provides high-level EMI/RFI shielding and offers long-term, maintenance-free RF performance and structural integrity, compared to mechanically clamped shielded enclosure designs. It supports requirements of 30Hz to 94GHz and exceeds the RF performance requirements of government specifications MIL-STD 284, NSA 65-6/94-106 and CID 09.12.

Circle (451) on Fast Fact Card

Service supplement features tool kits

Contact East's *Spring Service Supplement* includes products for testing, repairing and maintaining electrical and electronic equipment. Products highlighted in this issue include power supplies, cable testers, tool cases, shipping containers, telecom test sets, soldering supplies and ESD protection equipment. It also includes a 16-page insert of standard, custom and modifiable tool kits.

Circle (452) on Fast Fact Card

Catalog highlights IDEN accessories

Motorola Accessories and Aftermarket division has released a 44-page, color brochure describing the collection of accessories available to support Motorola's IDEN line of PCS handsets used by Nextel and Southern LINC, as well as dealer-based subscriber systems and Clearnet in Canada. Audio accessories for the various IDEN models are complemented by descriptions of carrying cases, car installation kits and chargers. A full line of Motorola original NiCD, NiMH and lithium ion replacement batteries are also offered.

Circle (453) on Fast Fact Card

Book details marketing considerations

The Complete Wireless Communications Professional: A Guide for Engineers and Managers from **Artech House** details engineering principles and examines the financial and marketing considerations that contribute to making any communications product viable. The book provides a relevant history of mobile radio, the technical basics of cellular and private mobile radio technologies and the descriptions of the design and operation of mobile networks.

Circle (454) on Fast Fact Card

Media correction

The "Media" item, "Color Brochure Describes Terminal" (*MRT*, June 1999), features an incorrect company name for the publisher of the Explorer II brochure. The correct company is Globecomm Systems, Hauppauge, NY.

www.globecommsystems.com.

people


Campbell


Perelman


Hoff


Snader

Guy Campbell departs Ericsson, Lynchburg, VA, as vice president, wireless business systems, to join Andrew, Orland Park, IL, as group president, wireless products and distributed communications systems.

Robert Perelman leaves Eupen Cable USA, St. Petersburg, FL, as vice president, sales, to rejoin Times Microwave, Wallingford, CT, as vice president, commercial sales and marketing.

Changes at Tru-Connector, Peabody, MA:
Robert F. Hoff, vice president sales and engineering, retires after 40 years at Tru-Connector. **Douglas E. Snader,** sales manager, succeeds Hoff as vice president of sales and engineering.

Francois Robitaille, director of international marketing and sales at Davicom Technologies, Trois-Rivieres-Ouest, Quebec, Canada, advances to vice president, marketing and sales.

Personal Communications Industry Association (PCIA), Alexandria, VA, award recipients:
Rep. Billy Tauzin (R-LA), chairman of the House Telecommunications Subcommittee, receives the Lifetime Achievement Award. **Thomas Tycz,** chief of the FCC International Bureau's Satellite and Radiocommunications Division, receives the Eugene C. Bowler Award.

Ian Shergold, managing director of Huber+Suhner AB in Sweden, moves to senior vice president of Huber+Suhner, Essex Jct, VT. Shergold succeeds **Les Judd** who transfers to start Huber+Suhner Integrations in Phoenix.

Changes at Trilogy Communications, Pearl, MS:
Bruce Carlson, director of the network product division and engineering, advances to vice president of the division. **Gary Cohen** leaves BNOX as director of finance and administration to join Trilogy as vice president of finance. **James J. Bottomley** departs Wavetek Wandel & Golterman, Research Triangle, PA, as director of sales to join Trilogy as national sales manager of wireless network products. **Stanley A. Nevers** leaves Motorola as a national account sales manager based in Atlanta to join Trilogy as eastern regional sales manager of network products. **Jim Oldham** exits Sprint North Supply, New Century, KS, as executive account manager to join Trilogy as vice president of domestic sales for its CATV products division.

Dale Sydnor, Noise Com's chairman, moves up to vice president of Eatontown, NJ-based Telecom Analysis Systems' new product development and support facility in Mahweh, NJ. He joins TAS as a result of the acquisition of Noise Com by TAS.

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COMMUNICATIONS TECHNICIAN

Continuous Testing / Several Openings

County of Santa Clara (San Jose, CA) seeks individuals to service two-way radio, microwave and computer equipment used in public safety communications. Experience required. Salary: $3,784–4,581 per month, includes County contribution to the Public Employees Retirement System for the 2% at 55 Plan; and includes payment by the County of the employee's regular contribution of approximately 7%. Excellent benefits.

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Ph: 816-524-1047. Fax: 816-246-0677.

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Motorola MSS in San Antonio, Texas, has immediate opening for a portable/mobile radio technician. Candidates should have extensive knowledge of Motorola portables and mobiles with emphasis on component-level repair. Candidate will also have extensive knowledge and experience working with service monitors, O'scopes, Power Meter, Freq. Counters and associated bench equipment. We offer competitive salary, Medical/Dental benefits and great working environment. Interested parties please fax resume to: (210) 226-5329, Attn: Greg.

Immediate opening for a **Portable Technician** in the Knoxville, TN area. Near the Great Smokey Mountains–a hunting and fishing paradise! Must have 5 years experience repairing Motorola and General Electric equipment. Excellent salary & benefits package. Contact Jim Hayes at **(423) 546-0311**.

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The City of San Jose, California, is seeking qualified applicants for the position of Communications Technician. Responsibilities include the maintenance and repair of land mobile type equipment, including mobiles, portables, pagers voting receivers, base stations, mobile data systems, dispatch consoles and microwave systems. Position qualifications require any combination of training and experience equivalent to completion of a two-year college curriculum in radio communications or electronics and one year of experience in the maintenance and repair of land mobile equipment. Motorola experience preferred. Positions also require an FCC General Radio Telephone certificate or equivalent certificate from NABER/PCIA or APCO, and the ability to pass a medical exam and police background. Apply A.S.A.P. Salary range is $4481.00–$5446.00 monthly. Applications may be obtained by contacting:

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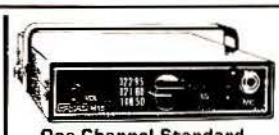

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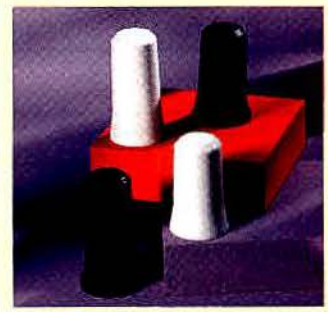

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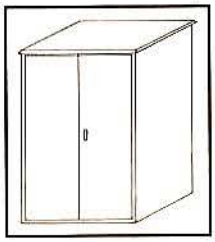

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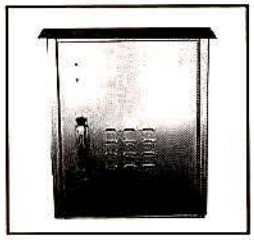

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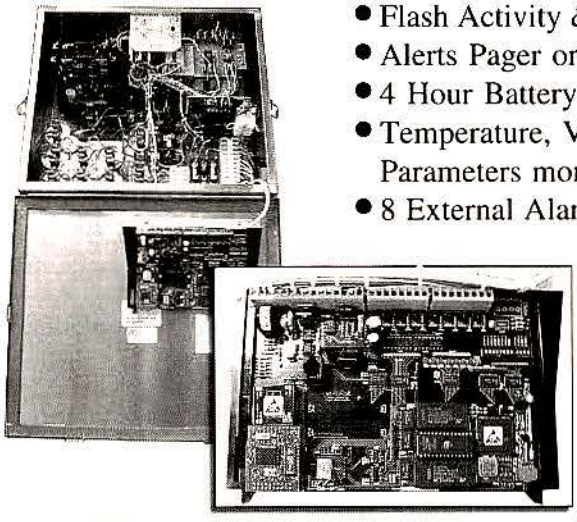

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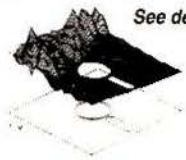

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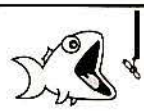

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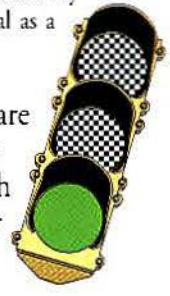

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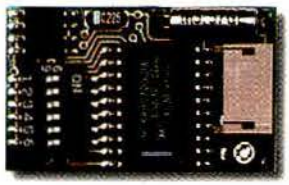

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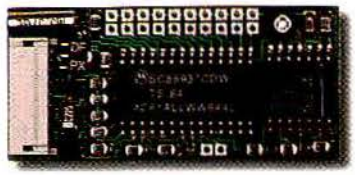

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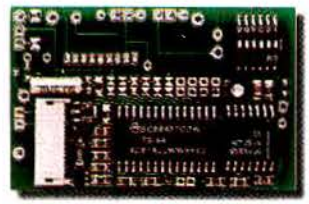

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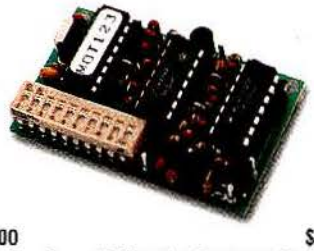

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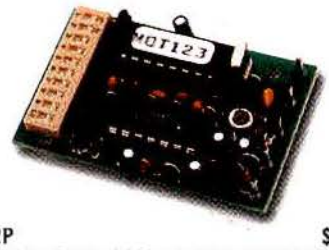

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